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DISSERTATIONS

ON

INFLAMMATION.

VOLUME I.

CONTAINING,

PRELIMINARY DISSERT.—ON SOME OF THE LAWS OF THE ANIMAL ECONOMY.

DISSERT. II.—ON THE HISTORY, CAUSES, AND CONSEQUENCES OF SIMPLE INFLAMMATION.

BY JOHN BURNS,

SURGEON IN GLASGOW.

GLASGOW:

Printed by James Mundell, Aytoun Court,

FOR JOHN MURDOCH, TRONGATE;

MUNDELL AND SON, AND W. MUDIE, EDINBURGH;

AND FOR LONGMAN AND REES, AND J. JOHNSON, LONDON.

1800.

TO

ANDREW DUNCAN, M. D.

PROFESSOR OF THE INSTITUTIONS OF MEDICINE

IN THE UNIVERSITY OF EDINBURGH;

THE FOLLOWING

DISSERTATIONS

ARE INSCRIBED,

AS A TESTIMONY OF ESTEEM,

AND OF THAT RESPECT

WHICH IS DUE TO HIS PROFESSIONAL LEARNING
AND ABILITIES,

BY HIS SINCERE FRIEND,

AND HUMBLE SERVANT,

JOHN BURNS.

Glasgow, May 10.
1800.

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VOL. II.

PREFACE.

THE foundation on which medical reafonings are built, is a knowledge of the laws and operations of the living principle; but as our acquaintance with thefe is exceedingly imperfect, the opinions which are formed from this muft be fluctuating, and frequently very uncertain.

WHEN phyfic firft became a fcience, the doctrines of its teachers were, of neceffity, rude and chimerical; and even after it had been ftudied for many hundred years, it continued to be obfcured

the ſoul of the univerſe, from which emanations went forth to enliven the individuals of the creation. Such being the doctrines of the philoſophers, medical reaſonings came naturally to be founded on the properties and changes of the material part of the frame, which changes were again referred to the operation of an intelligent and ſentient principle.

It was the diſcoveries of the immortal Newton, which firſt paved the way for the real improvement of medical ſcience; for he, in one great branch of natural knowledge, baniſhed completely the mechanical interference of intelligent agents, and taught the exiſtence of a principle purely immaterial, and which, without any wiſdom or volition, could act by being acted on. The mind now came gradually to be weaned from reaſonings totally material and mechanical; and phy-

ticians, by degrees, began to attribute the operations of the animal frame, not to a thinking power, which prefided with wifdom over the fyftem, but to a principle, which was implanted in man at his creation, and which, through the medium of the nerves, in which it was fuppofed to be lodged, carried on his functions, according to a rule eftablifhed from the beginning, without poffeffing either knowledge or judgment. It required, however, a ftep farther to banifh the doctrines of the changes of the fluids, and the belief in thefe as the caufe of difeafe; and fo ftrongly have thefe notions taken hold of the mind, that they are not yet altogether given up.

An examination into the properties and fource of this living principle, or nervous energy, as it has been called, forms the fubject of the Preliminary Dif-

ſertation, in which I have endeavoured to explain ſome of the principal laws and operations of the animal economy. The ſubſequent Diſſertations contain an inquiry into the nature and mode of treatment of ſome of the different ſpecies of inflammation, founded upon thoſe laws or properties of the living principle. Theſe are part of a courſe of lectures which I read upon ſurgery, three years ago, in the Royal Infirmary in Glaſgow.

I OFFER them now to the Public with much diffidence; but, at the ſame time, with a ſincere hope that they may be uſeful to others, in conſidering the ſame ſubjects, which are of the very firſt importance to every ſurgeon. If, in any part, I ſhall appear to be unneceſſarily tedious, I beg it to be remembered, that ſome of theſe poſitions differ from thoſe

commonly maintained, and, therefore, require to be more fully illuſtrated. I do not write to ſurgeons who already underſtand theſe ſubjects, but to ſtudents, who as yet have their knowledge to acquire, and to whom many illuſtrations are uſeful, which to others, who know more, may appear to be unneceſſary.

ERRATA.

The Reader is requeſted, with his Pen, to correct the following Errors, and to ſupply the Omiſſions which have inadvertently taken place.

VOL. I.

P. 22. l. 4. *For* cerebellum, *read* cerebrum.

P. 109. l. 7. *For* aſſociation, *read* aſſociation of diſtant parts.

P. 109. Before the laſt line, the following paragraph ought to have been inſerted, but was omitted.

The ſympathy of aſſociation may be divided into the interrupted, or the ſympathia conſociationis interrupta, in which diſtant parts are affected, whilſt ſound parts intervene betwixt them; and the ſpreading, or the ſympathia conſociati-

onis ſerpens, in which the action ſpreads inch by inch with more or leſs rapidity. The interrupted ſympathy generally is induced quickly, and, in many caſes, does not laſt long; the ſpreading takes place more gradually, and is, in every inſtance, of conſiderable duration. It may alſo come to affect parts which were formerly influenced by the interrupted ſympathy, and may overcome the natural tendency of particular parts to exhibit the ſympathy of equilibrium. The interrupted ſympathy is ſometimes the forerunner of a general action, the brain or ſtomach ſympathiſing before any other part of the ſyſtem.

P. 138. l. 2. At the word *laſſitude*, there ought to be a reference to the following note:

This proceeds, in a great meaſure, from the diminution of the action of the muſcles. In many inſtances, this diminution of natural action is productive of a very painful ſenſation, which is felt in moſt of the muſcles, and which cauſes the patient to complain of pain in his back and in his bones, whilſt in reality it is the muſcles alone which are pained. Sometimes this diminution of natural action is

productive of ſpaſmodic affections. I have known fevers uſhered in by convulſions of the whole muſcles of the body, eſpecially of the ſpine, and theſe continued during the period of formation.

P. 180. Note. *For* Lamentii, *read* Laurentii.

P. 276. l. 4. *For* whilſt, *read* whether.

P. 362. l. 10. At the word *mind*, there ought to be a reference to the following note:

In ſome rare inſtances, the change of action does not produce ſenſation, or at leaſt the ſenſation does not amount to pain. Diſſection proves, that in certain caſes, inflammation has exiſted, and has produced ſuppuration, without giving any very painful ſenſation to the patient.

P. 443. l. 10. *For* of, *read* off.

P. 449. l. 4. *For* prepared, *read* propoſed.

VOL. II.

P. 112. l. 6. *For* cold, *read* coldneſs.

DISSERTATIONS

ON

INFLAMMATION.

PRELIMINARY DISSERTATION

ON SOME OF THE

LAWS

OF THE

ANIMAL ECONOMY.

Introduction.

NATURAL hiſtorians have divided the objects of their examinations into three great claſſes, which have been called the kingdoms of nature; the animal, the vegetable, and the mineral.

Amongst all the different individuals of theſe diviſions, an organiſed form regularly prevails. A ſtone or a ſalt aſſumes uniformly an appearance which continues always the ſame in ſimilar ſpecies. The vaſt rocks of Baſaltes, which ſtand as ſo many monuments of the dreadful cauſe which produced them, conſiſt of large pillars, having five ſides of unequal dimenſions. Silicious cryſtals exhibit the form of hexagonal pyramids, whilſt the zeolite aſſumes the figure of a beautiful ſtar, and the amianthus that of regular and parallel fibres.

The vegetable has likewiſe its appropriate conſtruction, which, as in the other kingdoms, continues always the ſame; but in this reſpect it differs from the mineral, that to a regular figure there are conjoined organic veſſels to maintain and increaſe that form, according to the uni-

form action of a certain principle which they possess, and which has been called life. If the plant be cut through level with the earth, we soon find that the loss is supplied, and new sprouts formed, which produce leaves, flowers, and fruit, exactly similar to those which were cut down. If we apply a stimulus to it, a particular effect is produced, according to the nature of the application, or of the part acted on. If it be light, the organs of motion become affected, and the leaves turn toward the ray, or the flower-leaves open to admit the light and air to the parts of fructification. If heat be applied to the plant, in a slow and regular manner, it supports and assists the exercise of its functions, and consequently contributes to its strength and increase. But if it be applied hastily, and to a great degree, it disorders the action of that power which preserves the plant, and either dis-

eafe or death is the refult. The laws and operations of this power are few and fimple; but when we afcend to the animal creation, we find, that not only the ftructure is more complex, but alfo the modes of action are much more numerous.

The individuals of the laft clafs have promifcuoufly received the name of dead matter, becaufe, when compared with the other claffes, they appeared to be inanimate. But by a more accurate examination, we fhall find, that there is in reality no individual whatever in any of the kingdoms or claffes of nature which can be called inert, or truly dead. For, from the largeft maffes of matter down to the moft minute corpufcles, we diftinctly perceive the operation of an active and immaterial principle *.

* The particular nature of this principle, as we fhall afterwards fee, never can be afcertained. We are, however,

THIS principle has received different names, according as it manifests itself. The power which supports the functions (if I may use the expression), and regulates the motions and actions of the different parts of the universe, has been called gravitation; whilst the property which makes one particle unite with another, and which modifies the form, and produces the increase of the smaller bo-

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sufficiently assured, by the phenomena which we observe, that in all the classes of nature such a principle does exist. But the relation which the enlivening or vital powers of one class bears to that of another, cannot yet, if ever, be determined. Whether the same principle only exists in different degrees of perfection in these classes, or whether its nature be essentially different in each, will admit of much discussion. In this paper, however, I can only give a general statement of the idea which I annex to the principle of life, and afterwards mention, in so far as will be necessary for understanding the following Dissertations on Inflammation, some of the operations and qualities of the living principle in man.

dies, has received the name of corpuſcular attraction. The principle, again, which regulates the inteſtine changes, and determines the combinations and ſpecific ſtates of exiſtence in matter, has been denominated elective, or chemical attraction.

How matter, which by itſelf, and viewed abſtractedly, muſt be conſidered as inert and dead, ſhould be capable of combining with this active and immaterial power, it is impoſſible to ſay. But having from the creation perceived this union, we find it to be now impracticable to form a conception of matter unconnected with this property.

Without this enlivening principle, all nature muſt be dead; and matter deprived of it muſt either ceaſe to exiſt, or exiſt in a way which we cannot poſſibly

comprehend. The union of the whole univerſe muſt be diſſolved, and the beautiful dependence of one part on the reſt for ever deſtroyed. We know, and are taught to believe, that the Great Being who formerly ſent forth this active vital power, and bade the worlds live, will one day recal his gift. Matter ſhall then ceaſe altogether to be, or ſhall return to that unknown chaotic ſtate which poets have imagined, and vainly attempted to deſcribe *. The particular laws and operations of attraction, or the life of matter, belong for inveſtigation to the natural philoſopher; and therefore it will here only be proper to remark, that I conſider

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* "Ante, mare et tellus, et, quod tegit omnia, cœlum,
"Unus erat toto naturæ vultus in orbe,
"Quem dixere chaos; rudis indigeſtaque moles;
"Nec quicquam, niſi pondus iners; congeſtaque eodem
"Non bene junctarum diſcordia ſemina rerum."

Ovid.

animals, vegetables, and what is called inanimate matter, as all poſſeſſing an immaterial principle, differing greatly indeed in its nature and effects in theſe different claſſes, but ſtill deſerving, in all of them, the name of life, being of equal value to each, and abſolutely requiſite for their preſervation.

THIS power, we have ſeen, is exceedingly ſimple in common matter; but when we mount to the next claſs, that of vegetables, we find a much greater degree of perfection in the life, and much more complicated actions. We have not only the ſame properties which are poſſeſſed by matter, but alſo additional and very ſurpriſing powers. We find them always in a progreſſive ſtate of growth or decay, endowed with the property of changing foreign matter into a peculiar fluid, which is continually circulated

through their veſſels, and converted into a great variety of products. They are farther diſtinguiſhed, by having within themſelves the powers of motion, and of multiplying their ſpecies to an endleſs degree. We then find, that vegetables poſſeſs not only the principles proper to matter, but alſo a life peculiar to themſelves, and which, I may ſay, is built upon the former; for without attraction there can be neither growth nor organiſation.

WHEN we aſcend to animals, we find them poſſeſſed of a third ſpecies of life, built upon the other two. In this claſs, beſides attraction, or the preſerving and active principle of matter, we find reproduction, and the other properties of vegetable life; but theſe properties are exhibited with a different modification, and are united with others, which of them-

ſelves would, independent of the preſence of mind, diſtinguiſh them from vegetables.

We have, then, in the three claſſes of nature, three different ſpecies of life, each more perfect than the other, and increaſing gradually in their delicacy and intricacy. The moſt ſimple, or that of matter, is the moſt permanent, and on it the other two are built. I do not, however, mean from this to ſay, that attraction *, or the vital principle of matter, acts in the higher claſſes merely as attraction; or, in other words, that it remains unchanged in its properties. On the contrary, a very great alteration takes place; and, although it ſtill poſſeſſes the quality ex-

* This term is uſed ſometimes for the cauſe and ſometimes for the effect; but the ſenſe will always ſhow how it is to be underſtood.

preſſed by the word attraction, making the parts adhere together, it yet is ſo far changed and perfected, as to exhibit many other phenomena and new actions, of which, before this elevation, it was incapable. It is rendered not only more perfect, in this reſpect, of gaining new properties, but even its original quality of producing attraction is much improved; for a living muſcle will bear a greater weight, without laceration, than one newly dead, or one called, in common language, dead; which proves, that the vital principle, in animals, has a greater power of producing the effect called attraction, than the vital principle of common matter.

THE three claſſes run imperceptibly into each other; and thus we have a complete chain of exiſtence eſtabliſhed, from the moſt ſimple to the moſt com-

plicated body. Thoſe ſpecies of amianthus, which are called mountain cork, although minerals, yet reſemble vegetables ſo ſtrongly, that they link the claſſes together; whilſt the coralines, although animals, reſemble both minerals and vegetables. The fungi, though plants, conſiſt of the ſame principles with animals. Some of the fuci reſemble hair, and other cartilage; whilſt the ſponge, although an animal, grows like a vegetable. Not only the external and chemical qualities, but alſo the vital principle, and its phenomena, form a regular gradation in the different claſſes. Even in a ſingle individual of the two higher claſſes, we perceive the gradual elevation of one ſpecies of life into another. This change uniformly begins in the fluid part of the individual. In the plant, the firſt change produced on common matter, or the aliment, is its converſion into vegetable

juices, which exhibit certain vital phenomena, different from common fluid matter: afterwards organifation is added, in which the vegetable life is exhibited with moft perfection. In animals, again, there is a greater gradation, and more complicated change, before animal life be imparted in its greateft perfection. The food is firft converted into chyle, which has a lower fpecies of life than the blood, which again is more imperfect in its vitality than the organifed parts. The living principle of the blood differs, both in degree and kind, from that which belongs peculiarly to the animal; but thefe two are connected, and react on each other.

No fubftance or piece of matter, whether fimple or compound, has of itfelf a tendency to decompofition, or change of ftate. For effecting this, the principle of

attraction must be acted on by the addition of other substances, and then a new condition will take place. This is the foundation of chemistry, which is a science wholly built on the effects of attraction. Some have attempted to explain the changes or diseases of living animals by the same laws; but this method cannot be admitted, until it be proved, that their life does not give them properties different from common matter, and make them subject to another set of laws. When they are deprived of this life, then they become liable to the habitudes of matter, and may, by the agency of other substances, be decomposed, and differently combined; but, until their specific life be lost, they bid defiance to such changes; and, therefore, the system of pathology which has been built upon it must be false.

Life is a principle which we can only detect and judge of by its operations or actions; and, when theſe are not exhibited, we are apt, though ſometimes erroneouſly, to conclude, that the body is dead. The leading property of life, is to communicate a preſervative power to every individual with which it is connected. This is ſometimes effected by very evident and intricate actions; but, at other times, is exerted without any ſenſible operation. The cryſtal reſiſts, to a certain degree, mechanical impreſſions, which would deſtroy its form. The blood when newly drawn, the ſap of vegetables, the living egg, reſiſt cold, by an imperceptible operation, to a much greater degree, when alive, than after their peculiar life departs. They reſiſt all the efforts of chemical agents which act on common matter; nor is it poſſible to decompoſe or injure them in this way,

until they loſe their ſpecific life, and deſcend in the ſcale of exiſtence. This ſimple preſervative power is a diſcriminating mark of the preſence of life; but we cannot detect it until we apply deſtroying cauſes: It is the uniform and univerſal effect of the combination of life with any ſubſtance, whatever its nature or ſtructure may be: It is the eſſential characteriſtic of life, which it muſt ſhow whenever it is preſent. But, when we find vital power united with a certain organiſation *, then more varied phenomena take place; and theſe are called actions of the vital principle †. In the

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* I am only here conſidering animal life, without any connection with an intelligent principle or ſoul, which is quite a different thing from vitality.

† Every operation of the vital energy is called an *action*, and whatever agent excites this action is called a *ſtimulus*. The aptitude of the ſyſtem to be acted on has been expreſſed by the term *irritability*.

plant, the bud expands, the ſtem ſhoots up, the food is abſorbed, digeſted, and circulated ; air is thrown out, and particular ſecretions take place. In the animal, theſe actions are ſtill more evident, but more intricate, and infinitely more varied. They are the ſupport of our health, and the ſource of all our diſeaſe.

In the two firſt claſſes, the enlivening principle ſeems to be equally united with and dependent on every part ; but in animals, to whom I will now confine my attention, the principle which performs theſe actions is more directly connected with certain organiſed portions of the body, called brain and nerves, which ſupply every part, though ſo minutely, that we often cannot trace their courſe.

Of the Brain and Nerves.

THE brain* is a ſoft globular ſubſtance contained within the cranium, of

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* Were we to proceed regularly to inveſtigate the various phenomena of animal life, we would naturally begin by examining the compoſition and ſtructure of the different parts of the body. By this examination, we ſhould become acquainted with ſome fundamental facts, but ſhould ſtill be in the dark with regard to that principle which animates the whole, and enables the various functions to be carried on. An inquiry into the general laws of this energy, which is found to reſide in the brain and nervous ſyſtem, would, therefore, naturally become the ſecond object of our attention. Being acquainted with theſe, we would next examine the particular functions of man, and the operation of the nervous energy in ſupporting them. The gradual growth and increaſe of the animal, the depoſition of new matter, and the abſorption of the old, would be the firſt ſubject of conſideration in this part of the examination, and would naturally involve an inquiry into the proceſs of digeſtion, and the formation of the blood, with its qualities

a duſky colour without, but white in the centre. It is from this white or medullary portion, that we find all thoſe elongations ariſing, which have been called nerves, and which are juſt portions of the brain diffuſed over the body, and exerting there the peculiar properties of the ſyſtem to which they belong.

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and uſes. The powers of motion, the influence of the mind, and the hiſtory of the different ſenſes and various functions of man, would conclude this part of the inquiry. Having become acquainted with the healthy condition of the ſyſtem, and the cauſes which maintain it, we would apply this knowledge to the inveſtigation of the different derangements, or diſeaſed actions of our body, and their cure.

Such might be a proper plan for examining regularly the economy and diſeaſes of an animal; but this would be greatly too extenſive for the preſent purpoſe. It muſt here be taken for granted, that the ſtudent is acquainted with the ſtructure of the body, and with its different functions, by which he will be able to underſtand the following general obſervations on the properties of the living principle, and apply the doctrines more particularly himſelf.

These nerves poſſeſs different qualities, according to the portion of the brain from which they ariſe, and the organiſm of the part to which they go. Thoſe which go out firſt, ariſing from the mamillary proceſſes, and which are called olfactory nerves, are the ſource of the ſenſe of ſmelling. The ſecond pair, ariſing from a particular protuberance, or little brain, called the optic bed, give the important ſenſe of ſeeing; and, in order to connect thoſe two cerviculæ, or beds, we find their elongations joined, before they proceed out of the ſkull. The third, the fourth, the firſt branch of the fifth, and the ſixth pair of nerves, all ariſe from the cerebrum, and are diſtributed on the different parts of the eye, ſerving chiefly for the purpoſes of motion. The ſoft portion of the ſeventh pair ariſes from the fourth ventricle, and conſtitutes the auditory nerve. None of

theſe nerves ſupport the vital functions; they are all deſtined either for the organs of ſenſe, or the ſimple parts about the head.

The nerves which ſerve for carrying on the vital functions, all ariſe either from the medulla oblongata, or ſpinal marrow. I have ſeldom, in diſſections, found derangements of thoſe parts of the brain, but have often obſerved very great diſeaſe in the cerebrum. In one caſe, the cerebrum was hard and ſchirrus, but the cerebellum was ſound and healthy. This man died comatoſe, after being long tormented with violent head-aches. In another inſtance, although the lateral ventricles were ſo much diſtended with water, that the hemiſpheres of the brain were converted into little elſe than two bladders full of fluid, yet the child was ſenſible nearly to the time of death,

which was produced more by the preſſure on the cerebellum, which was not diſeaſed, than by the derangement of the cerebellum. In numberleſs inſtances, we find the ſkull beat in upon the cerebrum, or foreign bodies lodged in its ſubſtance, or abſceſſes formed in conſequence of blows and falls, and ſtill the patient ſurviving all the injury *. The phyſiologiſt has even removed this part of the brain altogether, in birds and other animals, without death being oc-

* I do not mean to maintain, that wounds of the cerebrum are not attended with great danger. I only wiſh to prove, that they are by no means ſo fatal as thoſe of the cerebellum ; and, conſequently, that the cerebrum is not ſo immediately neceſſary to the continuance of life. Spindler, and others, report inſtances of people walking about with part of the cerebrum gangrenous. Many inſtances of recovery from ſevere injuries done to this part, are mentioned in the Memoirs of the Academy of Surgery ; and every practical ſurgeon muſt have obſerved, how long a patient often ſurvives the moſt terrible accidents of the head.

casioned; the senses alone were destroyed. But it is equally well attested, that the cerebellum cannot be injured with the same impunity; for, from the history of those who are killed by blows on the head, and by experiments upon brutes, we find, that, in very few instances, does the animal survive, if this part of the brain be injured *.

We shall next find, that the cerebellum, comprehending its production, the medulla oblongata †, joined by a few

* Although Zinn, Fallopius, Veslingius, and others, consider wounds of the cerebellum as curable, and have cured individuals who were supposed to have this part of the brain injured; and although the illustrious Baron Haller mentions, that he had once seen the cerebellum schirrus; yet the observation of Bohnius, and others, who have wrote expressly on the subject, that these wounds are almost inevitably fatal, cannot be considered as invalidated by those solitary instances of recovery.

† The medulla oblongata is just a part of the cerebel-

branches from the cerebrum, is expanded or diffufed over the whole body. It paffes out of the fkull, and feeks defence in the vertebral canal, from whence it fends out elongations to all the different parts of the body, which, with thofe which pafs out from it in the fkull, fupport the exiftence of the animal.

These elongations *, or nerves, poffefs

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lum, and is of the fame importance to the living fyftem. We fee it fupporting life in infects, who are without a brain, and in acephalous monfters. Wounds of it are fatal and dangerous, in proportion as they are near the head; or, in other words, according to the value of the nerves which originate beneath them.

* Ariftotle believed, that the nerves originated from the heart; and his fucceffors taught, that the blood-veffels which proceeded from the heart, were converted, in the brain, into nerves. It is on this account, fays Van Horn, that, in anger, the blood boils, and the eyes flafh with fire.

a degree of energy, or vital power, in themſelves, independent of what they receive from the brain as their ſource. They are neither more nor leſs than continuations of the brain, poſſeſſing the ſame power, and endowed with a ſimilar quality. It would, indeed, from reflection, independent of experiments, be reaſonable to conclude, that the nervous energy muſt be diffuſed over all the body, although it reſides in a greater proportion in the brain, from whence it is ſent to ſupport the other parts of the ſyſtem. In general, the quantity of energy in a nerve is proportioned to its ſize; it is greateſt in the brain, and leſs in all the elongations, in a degree correſpondent to their magnitude*. The ſmall nerves

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* We muſt carefully diſtinguiſh betwixt energy and action, which do not always correſpond. The brain, which moſt likely contains the greateſt quantity of energy, con-

have a dependence upon the great, and theſe again upon the brain: An univerſal connection is thus eſtabliſhed, no one part of the body being of itſelf ſufficient for living *.

The delicacy of the nervous ſyſtem is proportioned to the perfection of the animal; and, therefore, it is chiefly by experiments on the individuals of the lower

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ſidered abſolutely, exhibits leſs action than many ſmall nerves; for I do not conſider the operations of the mind as an action of the nervous energy in the brain. Mind and nervous energy are totally different; and, once for all, I beg to mention, that I conſider the ſoul or ſpirit as diſtinct, and altogether out of the preſent queſtion concerning vital power, and its actions.

* Although the inherent quantity of energy appears to correſpond to the quantity of nervous medulla, yet the action does not, being greateſt in the extremities, or rather almoſt entirely confined to the extremities, which draw their energy from the trunks. Theſe ſeem to ſecrete the power, whilſt the extremities expend it.

ranks, that this doctrine is to be confirmed. At the same time, some assistance may be derived from what we occasionally observe in the more perfect animals. We find, for instance, that children have been known to grow and live in the womb without any brain, receiving their vital energy from nerves alone; which proves, that a brain is by no means essential to the mere presence of vitality in an animal. On the other hand, we observe, that particular nerves may lose their energy, although the brain remains sound, as we see exemplified in paraplegia and partial palsy. At other times, we find both the brain and the nerve sound, but the connection subsisting betwixt them destroyed; in which case the nerve has only its own inherent energy, and derives no assistance from the brain, or parts above. This is daily seen in curvature

of the ſpine*. The doctrine may alſo be confirmed, by the caſe of a gentleman, who was paralytic from the head downward, but the heart and bowels continued their action. Here the ſpinal marrow only was diſeaſed; and that portion of the brain which gave off the intercoſtal and ſympathetic nerves, as well as thoſe nerves themſelves, was healthy. But it is moſt beautifully proved, by the well-known experiments of applying zinc and ſilver to the nerve of an amputated limb, by which we produce contractions of the muſcles, and make the apparently

* It is neceſſary, however, that this interruption take place gradually, in order to accuſtom the nerve to exert itſelf, if I may uſe the expreſſion, independent of the brain: For, if we cut the nerve ſuddenly, we find, that the difference betwixt the energy inherent in the nerve, and that which it was wont to receive from the brain, is ſo great, that the parts cannot exiſt: The change is too great and too ſudden.

dead member move upon the table. It has been long known, that if we tie a ligature upon the phrenic nerve of a dog, the motion of the diaphragm ceafes ; but if we ftimulate the nerve below the compreffed fpot, by ftripping it either upward or downward between our fingers, the contraction of the diaphragm, for a time, returns. By experiments upon the amphibious and reptile tribe, the doctrine is afcertained to be true beyond all difpute. It is well known, that a frog will live, for a couple of days, after his head is cut off; that he will jump about, and will even, if we may credit the Abbe Spallanzani, return to the embraces of his miftrefs, if the decapitation has taken place during the payment of his addreffes. It is alfo known, that if we divide the fpinal marrow, the crural nerves being no longer affifted by the parts above, become weakened, having only

their own energy, and the limb is palsied; but ſtill there is energy ſufficient to continue the circulation; and "the "bones, if fractured, will unite." If we cut a frog acroſs, we may make the legs move for hours, by applying the zinc and ſilver; or, if we ſuſpend the lower half, by a wire, from the conductor of an electrical machine, we ſhall, by taking ſparks from the legs, exhibit a very groteſque dance.

The tortoiſe will live, after decapitation, for many days; and, if we may credit naturaliſts, has been known to ſurvive the extraction of the brain for half-a-year. The bodies of ſome ſerpents will move about, when irritated, even after being deprived of the head, ſkin, and heart: Kaau tells us of a cock, who run thirty feet after decapitation; and many

other inſtances, of a ſimilar nature, might, if neceſſary, be added.

FROM all theſe facts, it appears, that the nervous ſyſtem is one great whole, having its energy univerſally diffuſed over it, and inherent in every part.

A DOCTRINE ſimilar to this has occurred to many, and, among the reſt, to the ingenious Dr. Whyte; but he aſcribes to the ſoul what is here attributed to the nervous energy; and, by this theory, is obliged to involve himſelf in metaphyſical reaſonings, concerning the extenſibility of the ſoul, as taught by Gaſſendi, and others. According to him, when a muſcle is removed from the body, and placed at ten yards diſtance from the body, the ſoul extends to it over all that part of ſpace, and enables it to contract. When this muſcle dies, then we muſt either

ſuppoſe that part of the ſoul is loſt, or that it retracts itſelf again within the body; which being leſs than formerly, muſt have a greater proportion of ſoul; both of which ſuppoſitions would be ridiculous *.

Of the Nervous Energy.

MANY have undertaken to aſcertain the preciſe nature of the nervous energy, and the manner in which it is produced; but I apprehend, that no argument will be neceſſary to prove the vanity and abſurdity of the attempt: It eludes all our reſearches; it does not come under the cogniſance of our ſenſes; and we might juſt as reaſonably attempt to deſcribe and

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* Vide Whyte's Works, p. 202. "Of the Vital and "other Involuntary Motions."

comprehend a new ſenſe, or detail the intimate nature of an unknown ſubſtance.

The ancients believed this energy to be of a gaſeous nature, and maintained, that it was formed in the ventricles of the brain, from the air which we inſpired *. This air, according to ſome, operated in part indirectly, through the medium of the lungs; but it was allowed by all, to act chiefly, by a direct aſcent to the brain, through the cribriform lamella of the ethmoid bone. Thoſe who were reſolved to adopt implicitly whatever the ancients deſired them to believe, were glad to forget the olfactory nerve, which filled theſe holes up completely, and choſe rather to remember the pretended experiment, in which tobacco was found to tinge the brain, by being ſnuff-

* Galen de Util. Reſpir. cap. 5.

ed up the nose*. This supposition being, as they thought, proved, physiologists began to push the doctrines of the ancients still farther: They took up the conjecture where they ended, and attempted to explain the particular nature of the aëriform principle. Some called it a very thin air, impregnated with nitre; others, a mixture of air, sulphur, and saline matter: And, as every one is fond of making his own discoveries as important as possible, we find Mayow attributing this property to his nitro-aërial or oxygenous principle. This supposition was, in a manner, repeated by Barbieri, and has, of late, been revived by Dr. Girtanner, who can fill bottles, as well as nerves, with this principle of life and irritability.

Not less ridiculous than these conjec-

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* Fracassatus de Cerebro, p. 328.

tures, was that of Miſtichelli, who imagined, that the nervous energy was produced by a kind of fermentation taking place, between what he called the ſulphur of the blood, and a particular kind of air; or the conjecture of thoſe who believed, that hartſhorn was the true nervous ſpirit *.

THOSE who attended leſs to chemiſtry, and more to anatomy, diſbelieved theſe notions, and taught their own diſciples, that the nervous ſpirit was not ſo very volatile; that it bore a more near reſemblance to the other fluids of the human body, and conſiſted entirely of a finer portion of the lymph †.

THE Carteſians, who loved wonders,

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* Cheyne in the Phil. Princip. of Religion.

† Berger, p. 269.

called it pure flame, or a kind of neutral ſubſtance between flame and air*; whilſt the Newtonians, forgetting the accuracy which mathematics might have taught them, imagined their æther to be the principle of life. The ſuppoſition which Sir Iſaac Newton threw out, in the form of a query, was adopted by many, and, amongſt others, by Dr. Mead, who obſerves, that "this fluid, (the nervous e-"nergy,) ſo far as we can diſcover by "its effects, is a thin volatile liquor, of "great force and elaſticity, being indeed "moſt probably a quantity of the uni-"verſal elaſtic matter (æther), incorpo-"rated with fine parts of the blood, ſepa-"rated in the brain, and lodged in the

* Although they believed this, yet they were fooliſh enough to talk of valves in the nerves, as if this matter could be obſtructed or regulated by valvular folds. Vide Deſcartes de Homine.

" fibres of the nerves. This is the in-
" ſtrument of muſcular motion and ſen-
" ſation, a great agent in ſecretions, and
" indeed in the whole buſineſs of the
" animal economy *."

Other phyſiologiſts rejected this conjecture, concerning the action of a ſuppoſititious principle, and referred life to the operation of cauſes with which they were better acquainted. Magnetiſm and electricity were too wonderful agents to be overlooked: The laſt was by many ſuppoſed to conſtitute the nervous energy, and even of late we find ſome ſupporting a ſimilar doctrine †.

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* Mead's Works, 8vo, p. 14.

† See the experiments of Valli, Galvani, and others, on this ſubject. " The ſimilarity of the texture of the brain " to that of the pancreas, and ſome other glands of the " body, has induced the inquirers into this ſubject to be-

Partly, perhaps, from the abſurdity of theſe notions, and partly from chimerical principles, the very exiſtence of a nervous fluid was denied, and the agency of the ſoul or mind became more attended to. That the phenomena of life depended upon the rational ſoul, without the aſſiſtance of any other energy, was the opinion of ſome; whilſt others allowed the exiſtence of a peculiar power in the nerves, but maintained, that this was, to

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" lieve, that a fluid, perhaps much more ſubtle than the " electric aura, is ſeparated from the blood by that organ, " for the purpoſes of motion and ſenſation. When we re-" collect that the electric fluid itſelf is actually accumulat-" ed and given out voluntarily by the torpedo and gymno-" tus electricus; that an electric ſhock will frequently ſti-" mulate into motion a paralytic limb; and, laſtly, that it " needs no perceptible tubes to convey it, this opinion " ſeems not without probability; and the ſingular figure of " the brain and nervous ſyſtem ſeems well adapted to diſ-" tribute it over every part of the body."

Darwin's Zoonomia, Vol. I. p. 10.

the utmoſt extent, under the controul of the ſoul, which preſided, as an autocrator, with wiſdom, over all the operations of the living body.

HAVING given up the doctrine of a nervous fluid, it became neceſſary to explain how the nerves performed their various offices, particularly thoſe of motion and ſenſation, and how external ſtimuli acted on them. This they endeavoured to do, upon the mechanical ſuppoſition of tremors and oſcillations, which were excited by the impreſſing cauſe, and propagated along the whole courſe of the nerve. Much time was ſpent in examining the fibres of the nerves, and their direction; nor is there almoſt any courſe or direction which was not attributed to them *.

* Some ſuppoſed that the nerve conſiſted of ſpiral fibres, which could ſhorten and elongate; others, that it had ru

Another ſet of phyſiologiſts united the two theories, and admitted both the exiſtence of a nervous fluid, and the action of tremors *.

Concerning the abſurdity of all theſe opinions, I think it unneceſſary to make any obſervation. The doctrines ſurvived, for only a very little time, their inventors; and the more intelligent part of inveſtigators ſoon came to confeſs their ignorance of the nature of this principle.

If the notions which the older phyſi-

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gæ, which might be made greater or ſmaller; and that on this depended the action of the nerves. Whenever the nerve was tight, then the ſenſation was acute; and vice verſa.

* This opinion has been in part revived by Dr. Darwin, who ſuppoſes that the vital ſpirit produces motions or contractions; and builds his theory on the different kinds of motion.

cians entertained concerning the nature of the nervous energy were erroneous, we are not to expect that their explanation of its operation, or their application of their knowledge to the cure of diseases, should be more perfect. Their systems were full of quick motions and * slow motions of the nervous spirit, and tensions, and contractions, and relaxations of the nerves themselves, and fermentations, explosions, impulses, and pre-established harmonies. We may wonder how this could be suffered by men of sense, or how they could possibly explain

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* Part of the nervous spirit was, in their opinion, exhaled into the cavities of the body, or, by insensible transpiration, from the body; the rest was returned from the nerves, by the veins, to the heart, and sent from thence to the brain. Others supposed, that it passed into glands, or was condensed into lymph, and thus returned to the head through the medium of the heart. See the Works of Regius, Segerus, Gav.t, Lancisi, Targirus, &c.

diseases on these principles; but the wonder ceases, when we know that they founded their system of pathology more on the blood and imaginary humours, than on the nerves: Their doctrines were either chemical or mechanical, and they knew nothing of the peculiar and varied action of the nervous system.

Concerning the true and precise nature of the nervous energy, nothing ever can be said; because it never can come under the cognisance of our senses; and even concerning its production and operations a very great deal is conjectural. We know, however, that there is such a principle, and that this principle, by the application of certain stimuli, exhibits certain actions or operations which are essential to life, and in which it consists. These actions, in the aggregate, may be

called the natural and healthy action * of the syſtem ; and the preſence of this action is abſolutely requiſite for the continuance and ſupport of the energy †; for,

* It is not eaſy to give ſuch a definition of the *natural action* as ſhall not be liable to be miſunderſtood. It does not conſiſt of digeſtion, ſecretion, &c. conſidered as a group of ſeparate and diſtinct functions, but in a peculiar indeſcribable condition, which exiſts in health, and of which theſe operations are effects, rather than parts : Still, as the right performance of all theſe functions depends upon the natural and healthy action of the ſyſtem, theſe, taken collectively, may give ſome idea of this action. Part of the natural action conſiſts in the renewing or producing of the nervous energy, which is to be conſidered as a ſpecies of ſecretion.

† It may be ſaid, in objection to the ſuppoſition that the renewal of the energy is an immediate and direct effect of the natural action, and flows neceſſarily from it, that, were this the caſe, an increaſe of the natural action ſhould not produce weakneſs in the end. But this idea proceeds from not rightly underſtanding the natural action, which is not a diſtinct aſſemblage of functions, but a general and peculiar condition, of which theſe functions make a part ;

whenever the aĉtion becomes changed, either in degree or nature, weakneſs is the conſequence; and this weakneſs is proportioned to the difference betwixt the diſeaſed and natural aĉtion of the ſyſtem.

The brain has, by almoſt every phyſiologiſt, been conſidered as the preparer and ſource of this energy; and, even in the preſent day, is ranked amongſt the ſecreting glands. That this energy exiſts in the brain and nerves, and that it exiſts in greater and leſs quantity, at different times, is undoubted. The

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and, therefore, although an increaſe of a particular function, ſuch as muſcular motion, does expend more energy than is produced, and conſequently weakens, yet a general increaſe of natural aĉtion, if it be not to ſuch a degree as to change its nature, and thus impair it, does augment the quantity of energy, and produces ſtrength; if it be changed, then it weakens.

embryo contains lefs energy than the child, and the child much lefs than the adult. He who is reduced, by abftinence and long ficknefs, has much lefs energy than the healthy and robuft man. Thefe facts require no proof; for the imbecillity of the natural action of thofe people, and their inability to fupport difeafe, proves it beyond doubt *. It is neceffary, however, here to remark, what

* It is likewife certain, that particular parts of the body have lefs energy than others, and, confequently, lefs action. A part is only capable of acting by means of its energy; and the degree of the one muft always correfpond to that of the other. The capability of fupporting difeafe is proportionate to the ftrength or degree of natural action: Hence children bear difeafe worfe than adults, and weakened parts worfe than thofe which are ftrong: At the fame time, we cannot expect to fee the difeafed action fo great in them as in the ftrong, although it is fuch as to deftroy them; becaufe the energy which is to fupport it is lefs. Still, although it be not confidered as abfolutely as ftrong or great, yet, relatively confidered with regard to the power, it is greater.

will be afterwards more fully explained, that we are not to confound an appearance or feeling of weaknefs with real and abfolute diminution of energy *; because certain temporary morbid actions may take place, which, by their diminution of the natural action, for a time, give the appearance of weaknefs. This proceeds fometimes from a fimple diminution or fufpenfion of natural action; at other times, from the energy being employed in an action diffimilar to the healthy one. At the fame time, if this

* Whenever the natural action is leffened, weaknefs is felt; and this is more obfervable, in proportion as the diminution is fudden. Emotions of the mind, and many other caufes, by leffening fuddenly the natural action of the fyftem, produce fyncope; but, in a few minutes, the perfon is often as ftrong as ever. Here we cannot fuppofe a fudden lofs and reftoration of energy; it was only the action which was affected; but, had this action continued for any confiderable time, then real lofs of energy would have followed, upon the principles already laid down.

action does continue for any confiderable time, real diminution of energy will take place; becaufe a certain action is neceffary for the fupport of the energy; and, in health, this action always bears an exact proportion to the degree of energy. The action of the energy is often very fuddenly leffened, in which cafe, weaknefs or fyncope is the confequence; and often it is as fuddenly reftored, in which cafe our ftrength returns. Energy may be fuddenly leffened, but it never can be fuddenly reftored.

This energy is not produced in confequence of the ftructure of the nerve, or by any power proper to the nerve, and neceffarily connected with a medullary texture. If it depended on ftructure alone, man fhould live as long as his fabric remained unimpaired; and if it depended on any peculiar power of the

nerves, diſtinct from the action of the energy itſelf, we muſt acknowledge a new principle; we muſt obſerve its operations, and aſcertain what cauſes influence it, which will only multiply difficulties.

It may perhaps be ſuppoſed, that the energy remains almoſt always the ſame, and that its action or operation only changes; but, in this caſe, whenever any action ceaſed or decreaſed, the quantity of energy ſhould accumulate, which is an abſurd idea. Some ſuppoſe an accumulation of the living principle; but the idea is ridiculous; for energy can never exiſt without action. Action requires energy; it conſumes the energy, which muſt be replaced. If this were not the caſe, we need only excite the action by ſtimuli, and life ſhould go on. As long as the blood circulated, action and life

ſhould be kept up, even without food. Death indeed would at laſt take place, from want of materials to ſupply the body, conſidered mechanically; but ſtill the man ſhould live for a long time, and until he conſiſted of little elſe than bones, nerves, and veſſels. Man might, upon this ſuppoſition, be rendered immortal.

Of the Blood.

FOR the ſupport and production of the nervous energy, a certain ſubſtance, namely, arterial blood, is requiſite. This fluid, by its circulation, not only acts as a natural ſtimulus to the nerve, exciting and ſupporting its action, and thus enabling the energy to ſubſiſt, but it alſo affords the materials from which the energy is drawn. It was formerly mentioned, that there is nothing which

can be called truly dead; that a vital principle pervades every ſubſtance, and extends its influence over the whole univerſe. This principle, it was mentioned, exiſts, in different degrees of delicacy, in the different claſſes of nature, and exhibits a regular gradation of perfection, in the different individuals. Common matter poſſeſſes a peculiar kind of life: When this matter is taken into the vegetable, not only its organiſation, but alſo its life, is changed, and we obſerve a very different appearance, both in the mechanical and vital ſyſtem; but, when the vegetable is deſtroyed, then it becomes again, both in its ſubſtance and life, the ſame with common matter. When the vegetable is taken into the animal ſyſtem, we likewiſe find a change, both in life and texture. We have then a certain gradation, which remains uniform; the material part of the one claſs forms the material

part of the other, and the vital principle of the one forms the vital influence of the other *. This change uniformly begins in the fluids. In the vegetables, the ſap, and in animals, the chyle, which forms the blood, is the firſt ſtep towards the change of life. Theſe ſubſtances conſiſt of matter, having a life proper to itſelf, differing as much from the active principle of common matter, as it does from the peculiar life of the individual, conſidered as an organiſed body, and a whole.

From the blood is formed the material part of the animal, and likewiſe its life, or nervous energy. Neither the material part of vegetables can be convert-

* It muſt here be obſerved, that there is a material diſtinction betwixt life and ſoul, or mind: They differ eſſentially in their nature and operations.

ed directly into animal ſubſtance, nor their vital principle into nervous energy: There muſt be intermediate ſteps, and theſe are the chyle and blood. Vegetables, when alive, differ from animals, in compoſition, in organiſation, and in the qualities of their life. When taken into the ſtomach, and in a ſtate of digeſtion, they differ from animal ſubſtances, in the ſame circumſtances; but, when the living power of the animal has begun to operate in the formation of chyle, the diſtinction no longer ſubſiſts, at leaſt to the ſame extent. A new ſubſtance is formed, and from this another, which is the blood; and from this an organiſed ſubſtance reſults, poſſeſſed of a more intricate ſtructure, and a higher ſpecies of life *.

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* Every part of the body dies, and is replaced. If even a ſmall part be removed, it is reproduced, and the

Besides this ſource of the living principle, ariſing from the converſion of food into blood, and the conſequent change of the one kind of life into the other, the blood likewiſe derives vitality from the air, during reſpiration. It may be conſidered as a fact, that whenever matter becomes part of a vegetable or animal, its active principle likewiſe becomes changed or elevated into the ſpecific life of the individual of which it becomes a part. Now, we know, that, in the courſe of 24 hours, about 8640 cubic inches of oxygen * are combined with the blood, and

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new matter poſſeſſes the properties of the old. The nerves themſelves, if divided, will unite; and the uniting ſubſtance is, to all intents and purpoſes, nerve. See Dr. Haighton's Paper in the Phil. Tranſ. on the Reproduction of Nerves.

* It is computed by chemiſts, that, beſides the portion of oxygen, which combines with the carbone and hydrogen, in reſpiration, 360 cubic inches of that air *diſappear* in an hour

become a conſtituent part of it, which affords a very abundant ſupply of vitality. The conſtant action of the ſyſtem requires a much more frequent renewal of life, than we can ſuppoſe to be yielded by the food, when converted into chyle and blood. We likewiſe find, that, in many diſeaſes, no food, or almoſt none, is taken into the ſtomach, for weeks, although the action of the ſyſtem be very great *. Reſpiration is a conſtant and

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This oxygen changes its ſtate in the blood; for I know of no experiment which proves, that it is found in a gaſeous ſtate in the blood. This opinion, of reſpiration being ſubſervient to the production of vitality, is alſo adopted, in one reſpect, by Dr. Darwin, who ſuppoſes, that an æthereal fluid is yielded by the air to the blood, and ſecreted from it again by the brain. *Zoonomia*, Vol. I. p. 471.

* The drink uſed during illneſs, may reaſonably be ſuppoſed to aſſiſt in the production of vitality; but it cannot of itſelf yield enough. By being long boiled with a little farinaceous ſubſtance, water yields more nouriſhment, and more life, than either it or the farina would do ſeparately

uniform fource, from which the expenditure of energy can be, in fome refpect, fupplied; becaufe the active principle, in oxygen, is thus conveyed to the blood, during its combination with that fluid; but refpiration alone, without food, is not adequate to the neceffities of man, both becaufe the life thus attained is not equivalent to the demand, and alfo becaufe the materials of nourifhment are with-held. The vitality yielded by the food, is, if I may fo fpeak, more permanent, and is united with the ftructure of the body, when the depofition of new matter is made by the blood. The vitality furnifhed by the air feems to be yielded to the nerves, during the courfe of circulation, for the immediate performance of the actions of the fyftem.

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and unboiled; but, in ficknefs, it is not employed in this form. See Count Rumford's Effays.

As the elevation of life, or the converſion of the lower into the higher, begins in a fluid ſtate, ſo alſo does its deſcent. The ſolid parts of animals are continually changing into a fluid or lymph, which is thrown out of the body*, as unfit again to become organiſed animal ſubſtance, until it has undergone new changes, and been converted either into vegetable matter, or animal ſubſtance of a lower degree. Even the nerves themſelves terminate directly in a ſoft and fluid matter; and perhaps it is only when the nervous energy is leaving the body, that it is

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* This lymph is, along with the chyle, poured, by a common trunk, into the ſubclavian vein. It is then, after paſſing through the lungs, circulated along the body, and is, moſt probably, the ſubſtance from which the different excretions are formed: It is thus thrown out of the body, and begins to aſſume new ſtates and conditions, and to anſwer other purpoſes, in the general and extenſive operations of nature.

capable of action; at leaſt, we find, that action is uniformly attended with an expenditure of energy; and the greater the action, the more ſpeedy is the loſs of energy: We likewiſe know, that it is only the extremities of nerves which act.

I HAVE ſaid, that for the production of this energy, and the ſupport of its action, the preſence of arterial blood is neceſſary. This is one of the natural ſtimuli to the ſyſtem, and excites thoſe operations of the nervous energy which are neceſſary for life, and which, in the aggregate, are called the natural action. This action is, in common language, called life *, whilſt the energy which

* This expreſſion came to be uſed, from obſerving, that whenever this action ceaſed, the body was dead. In the ſame way, we apply the word heat to the ſenſation or action which it produces oftener than to the principle which cauſes it, which of itſelf is not hot.

produces it, being unſeen, is overlooked. The continuance and preſence of this action, is neceſſary for the preſervation of the energy in the body, and for its production. Arterial blood, then, is of the utmoſt importance, as it not only affords the material from which life is drawn, but alſo is one great cauſe or exciter of that ſeries of operations, which are neceſſary for the renewal of the energy, and its preſervation in the ſyſtem.

THIS fluid has, at all times, received particular attention from phyſicians, and its compoſition has been examined with more accuracy than perhaps was neceſſary for the practice of phyſic. But, as formerly the ſyſtems of pathology were founded almoſt entirely on the different ſtates, real or ſuppoſed, of the blood, we cannot wonder at the attention which was paid to it. Notwithſtanding the

many obſervations which were made upon this fluid, and the various opinions which have prevailed concerning it, it is only of late that it has been ſuppoſed to differ from common matter, or to poſſeſs any living principle.

Mr. Hunter, who was the firſt who taught that the blood was alive, founded his opinion, not upon general reaſonings on the nature and extenſive operations of a living principle, or upon the neceſſity of the thing, but upon the obſervation of certain particular phenomena, and eſpecially on the coagulation of the blood. This living principle he ſuppoſes to be the ſame with that of the reſt of the body, and that ſomething ſimilar to the brain is diſtributed through the blood *, which

* " I would conſider, that ſomething ſimilar to the ſub-
" ſtance of the Brain is diffuſed through the body, and

he calls the diffused matter of life. This conjecture cannot be admitted; because, in the first place, it supposes, that life depends upon a particular substance or species of matter; and, in the second, we cannot see how, or by what power, this

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" even contained in the blood, and between this and the " brain the communication is kept up by nerves." Hunter on the Blood and Inflammation, p. 89.——Are we then to consider that the brain is a mass of life, and that a similar matter is diffused over every part of the body, and floats in the blood; that the nerves are quite different in their nature from the brain, and consist of different materials, and are endowed with a different and distinct power or principle, acting merely as connecting lines betwixt the life of the brain and the life of the body, or literally as chordæ internuntiæ? Does life indispensibly require, for its presence and existence, something similar to the substance of the brain? and does it exist wherever this medulla is to be found? Do we observe any thing like this in plants? Do we see it in muscles, in ligaments, in bones? or has it ever been detected in the blood? Vitality may exist in substances, with very different structures and organisation: and I have already mentioned, that the living principle itself varies very much in different individuals and classes,

ſubſtance is to be formed in the blood. I have already mentioned my idea of life, and its gradation; and alſo, that the blood ſeems, in a perfect animal, to be the firſt ſtep toward the converſion of common and vegetable matter into a ſubſtance poſſeſſed of animal life; but that this life differs as much from the peculiar life of the animal, as it does from that of the matter from which it is formed. Blood is to be conſidered, in one reſpect, as extraneous to the body, operating and exciting to action as an extraneous body, and yet poſſeſſed of powers, which ſhow it to be endowed with a peculiar life. We are to conſider it in two views; firſt, abſolutely, as a living animal ſubſtance, having peculiar properties, and conſiſting of different parts, kept together by life, and ſeparating, when dead or dying: Second, relatively, as the ſource of increaſe and nutrition,

and as making a part of the animal body, acting upon it as a ſtimulus, and being itſelf acted upon by the veſſels which contain it. This reciprocal action and reaction is abſolutely neceſſary for the preſervation of each; for, if either fail, both die. As long as the blood is alive and perfect, it produces the life of the animal, and ſupports its action; and, as long as the animal and its veſſels are living and healthy, the blood is kept perfect and alive. When the animal becomes diſeaſed, the life of the blood becomes alſo affected, and its peculiar quality is injured. The proper characteriſtic of blood, conſidered abſolutely as a living ſubſtance, is its tendency to become ſolid, or coagulate. If its vitality be not previouſly injured, it uniformly becomes firm, and its parts ſeparate, as ſoon as it is removed from the action of the veſſels; and, whenever this coagulation takes

place, it ceaſes to be blood; it dies. Mr. Hunter ſuppoſes, that this coagulation is to ſerve a uſeful purpoſe with regard to the body, and particularly, that it becomes the means of nouriſhment: But nouriſhment and increaſe depend upon a much nicer proceſs; and coagulation never can, and never does, ſerve any uſeful purpoſe, otherwiſe than mechanically ſtopping a hemorrhage; in which caſe, it is preciſely ſimilar to any other dead body; and, whenever coagulation does take place, it becomes abſolutely uſeleſs to the animal, in any other point of view, and can no more ſerve the purpoſes of blood, than the curd of milk can. Mr. Hunter, however, is of a very different opinion; for he believes, that the coagulum is ſtill alive, and poſſeſſed of the power of action within itſelf; that it can form veſſels, unite itſelf to the ſurrounding parts, and aſſume actions and appearances ac-

cording to the nature of the ſurrounding parts. "The moment it is at reſt, (ſays "he,) it begins to form itſelf into a ſo-"lid, and changes into this or that par-"ticular kind of ſubſtance, according to "the ſtimulus of the ſurrounding parts, "which excite this coagulum into ac-"tion, and make it form within itſelf "blood-veſſels, nerves*," &c. If this were the caſe, an aneuriſm ought never to burſt; becauſe, when the blood coagulates, the old coat of the veſſels ought to aſſimilate it into a new one. Every obſervation confirms the opinion, that, when the blood coagulates, it dies; but how or why it does coagulate, never can be aſcertained, more than how or why other actions are performed, the utility of which we do not clearly diſcern. Arterial blood coagulates rapidly, and into a maſs:

* Hunter on the Blood, &c. p. 86.

Veinous blood coagulates ſlower; the ſerum ſeparates freely, but the red globules are mixed with the lymph. In ſome diſeaſes, it is ſtill ſlower, and a buffy cruſt is formed from the ſeparation of the globules. In others, it never takes place; the blood, from the action of the body, being almoſt deprived of its vitality, before it can come into a ſtate of reſt. This we ſee in the effects of great fatigue, lightning, poiſons, bad fevers, &c.

The complexity of the vaſcular ſyſtem appears, in every animal, to be proportioned to the perfection of the nervous ſyſtem; and the purity of the blood uniformly correſponds to the delicacy of the living principle. It would be uſeleſs here to mention all the mechanical variations which take place in the heart and veſſels of different animals: It will be ſufficient

to obſerve the particular conformation which affects the purity of the blood. In every animal, where the living principle is naturally of a low degree, (by which I mean, of a kind incapable of exhibiting the actions of an animal, in the perfect manner in which they are performed in man,) the blood is impure.

In the frog, we find a heart, conſiſting of one auricle and one ventricle: The blood, being returned from the body by the veins, goes into the auricle, and from thence into the ventricle: This ſends out a large trunk, which ſoon divides into two: Theſe again, ſhortly after the firſt diviſion, ſubdivide into other two branches: One of theſe branches, on each ſide, goes to the lungs, and the other turns down, to join with the one ariſing from the other ſide: Theſe laſt uniting, form a large aorta: The branch-

es, which are diſtributed on the lungs, or bladders of air, carry their blood thither, from which it is returned into the auricle. But I have already ſaid, that all the veinous blood from the body was alſo returned to the auricle: There muſt, therefore, be in the heart a mixture of arterial blood from the lungs, and veinous blood from the body; and it is this impure blood which circulates in the arteries, and ſupplies the body.

In the turtle, we have diſtinctly two auricles and two ventricles, forming a double heart, ſimilar, in this reſpect, to the heart of man; but, as theſe two ventricles communicate by a hole in their ſeptum, they are to be, in reality, conſidered only as one cavity. From the right ventricle, or, more properly ſpeaking, the right ſide of the joined ventricles, ariſe the aorta and pulmonary ar-

tery; the one ſupplying the body, the other running directly to the lungs, from which the blood is returned, by the pulmonary vein, into the left auricle; from this it is ſent into the left ventricle, and thence, through the hole in its ſeptum, into the right ventricle; ſo that, ſetting aſide all this round-about courſe, we may ſay, that the blood is returned from the lungs into the right ventricle. The blood, again, which is ſent out by the aorta, is returned, by the vena cava, into the right auricle, and from this into the right ventricle, where it meets with the blood from the lungs. There is, then, a mixture of veinous and arterial blood in the turtle, juſt as in the frog; and this mixture is ſent again, in part, through the lungs, and the reſt through the body.

In the crocodile, the ſame happens;

only, the two ventricles have no ſeptum, but form one bag, without any diviſion.

The conſequence of this conſtruction, in theſe animals, is, that the blood, which is ſent to the lungs, is never entirely veinous, but partly veinous and partly arterial, by which the ſupply of air will laſt longer, and the animal require to breathe leſs frequently. But, ſecondly, the effect of this conſtruction, and the conſequent impurity of the blood upon the ſyſtem, is, that the life of the animal is of a leſs delicate nature, than that of thoſe animals, where the blood is pure: Their action is not raiſed to ſuch a degree, as in the higher claſſes; and all the operations of their ſyſtem are of a lower nature. This, which is an imperfection in one ſenſe, is, however, a degree of perfection, greater than we find in man, if we view life only with regard

to its preſervative powers; for thoſe animals, whoſe life is of ſo low a kind, that it is not ſuſceptible of quick actions, are a long time of being deſtroyed, by ſuch cauſes as would inſtantaneouſly kill any of the higher claſſes: We may remove their brain, and thus materially injure that ſyſtem, in which the ſpecific life is reſident; we may cut out the heart, and thus deſtroy the circulation; or, we may prevent the purification of the blood, by removing or cutting up the lungs; and yet the animal, under any or all of theſe cauſes, will continue to live for many hours, ſometimes for months.

Where the life is of the higheſt kind, but its quantity naturally ſmall, and the action required, at a particular time, is very little, we likewiſe find the blood impure. This we ſee to be the caſe in

the fœtus in utero, where the action required is very trifling, and where the heat produced * (which generally bears a proportion to the natural purity of the blood) is little.

In the child in utero, "† the blood "is received pure from the placenta by "the umbilical vein, and is conveyed "by it to the navel of the child. Here "the vein enters, and paſſes into the liver, dividing in it into many branches, "which ramify through the ſubſtance of "that gland, whilſt the continuation of "the trunk runs forward, and terminates in one of the branches of the vena portæ. Thus, we find, that one

* As the fœtus is placed in a medium as warm as itſelf, very little heat is neceſſary to be produced, in order to keep it at its proper ſtandard,

† Anatomy of the Gravid Uterus, p. 135. et ſeq.

" portion of the pure blood of the um-
" bilical vein is diſtributed to the liver,
" whilſt the reſt is ſent directly to the
" right auricle of the heart; but, previ-
" ouſly, it is mixed in its paſſage with
" the impure blood in the vena portæ
" and vena cava.

" There is, then, by this contrivance,
" a mixed blood in the right ſide of the
" heart, which is purer than the veinous
" blood of the fœtus, but much leſs arte-
" rial than the blood of the arteries after
" birth; from which we may infer, that
" a very great change takes place in the
" ſyſtem and conſtitution of the child
" after delivery. When the right ven-
" tricle contracts, the blood is not ſent
" through the lungs, as it is after birth,
" but directly into the aorta, at its cur-
" vature, by a veſſel running from the

" pulmonary artery into the aorta. By
" this conſtruction, we ſee that very
" little blood ſhould enter the left auri-
" cle; and, conſequently, that the whole
" left ſide of the heart ſhould be al-
" moſt empty. But, to prevent this cir-
" cumſtance from happening, we find
" an opening or valve in the ſeptum, be-
" twixt the auricles of the heart, which
" permits the blood to flow from the
" right to the left ſide directly, and then
" the whole heart is equally filled. It
" is for preſerving the heart in a ſtate
" fit for acting after birth, that we
" have both a foramen ovale, and a
" ductus arterioſus. Either of theſe,
" individually, would have ſerved the
" immediate purpoſes of the fœtal cir-
" culation: But, by thus dividing the
" blood, both the pulmonary artery and
" the left ſide of the heart are kept

" of a proper ſize, and in a due ſtate of
" action *.

" By the aorta, this ſemi-arterialized

* " The uſe of the ſides of the heart is, in one reſpect, " the reverſe in the fœtus of what it is after birth. In the " fœtus, the right ſide receives the pureſt blood, whilſt the " left receives it after birth. In the adult, the blood which " is in a ſtate fit for circulation, is collected in the left ſide; " and, therefore, the great artery of the body ariſes from " that ſide. On this account, there muſt of neceſſity be a " communication betwixt the aorta and the right ſide of the " fœtus, which performs the functions of the left ſide of the " adult heart. If this communication does not cloſe up " after birth, then the contents of the right ſide continue " ſtill to be ſent into the aorta. But as the quality of the " blood of the right ſide is now materially different, very " different conſequences take place from thoſe which re- " ſulted from the ſame mechaniſm before birth. The " whole blood of the body is now rendered impure, the " purpoſes of circulation are only half performed, and the " unfortunate individual drags on a moſt miſerable exiſt- " ence, until he ſinks prematurely into the grave. One " man, from whom I procured a preparation of this kind " of heart, lived this unhappy life for forty years."

" blood is diſtributed to the body; but,
" inſtead of the whole blood in the de-
" ſcending aorta being conveyed to the
" viſcera and inferior extremities, one-
" half of it is ſent directly to the pla-
" centa; for the internal iliac arteries
" turn upward to the navel, through
" which they paſs, and form the two
" umbilical arteries. The blood, there-
" fore, which is returned to the placenta,
" is as pure as that which circulates in
" the arteries of the child, and, therefore,
" requires a leſs change to convert it in-
" to the ſtate in which we find it in the
" umbilical vein."

If, by any means, the blood be not ſufficiently purified, or, in other words, if it do not poſſeſs, to a ſufficient degree, the properties of blood, we find, that the powers of life are ſmall, the actions of the whole ſyſtem are imperfectly carried

on, and the individual ſinks prematurely into the grave. When, as has been already mentioned, the adult heart remains in the ſame ſtate with that of the fœtus; when the pulmonary artery is deficient; when the two ventricles communicate, and the aorta ariſes from each; or, when the lungs themſelves are injured, or ill-formed, then the moſt diſtreſſing ſymptoms take place; diſtreſſing, on account of the general condition of the ſyſtem, but ſtill more painful, from the local affection produced in the cheſt. The effect, however, of the want of arterial blood, is more immediately ſeen in caſes of ſuſpended reſpiration. In hanging or drowning, death is produced by the want of arterial blood; and the univerſal method of cure has been, to attempt the reſtoration of reſpiration, although this has not always been done upon the true principle. By inflating the lungs, reſpi-

ration is often reftored, but it alfo very frequently fails; becaufe the mere blowing in of air neither infallibly excites the action of the lungs, nor does it, as fome fuppofe, change the blood; for this change is an action dependent on life, and cannot be imitated by the chemift more than digeftion. The alteration of the blood does not depend, as many imagine, merely on the prefence of air; a peculiar action of the lungs, or their veffels, alfo is neceffary. Food and air are to be confidered in the fame light, both only fupplying materials for the fyftem to act on, and not themfelves acting independently of the animal. When inflating the lungs does not very fpeedily reftore their action, and confequently the change of the blood, we ought to transfufe arterial blood from another animal, and thus reduce the perfon to the ftate of the fœtus, whofe blood is purified by lungs out of the body.

Of the Pulse.

I HAVE ſaid, that it is the pure or arterial blood alone, which is valuable to the ſyſtem, conſidered as a whole, and which preſerves the life, and yields the nouriſhment of the body. This is ſent out from the heart, as a ſource to all the different parts of the body, by regular and continued contractions of the heart and arteries, and is returned by the gentler action of the veins. Theſe contractions depend upon the living principle, connected with the muſcular coats, and muſt be influenced, in their frequency and force, by the ſtate or action of the energy of the ſyſtem in general, with which they ſympathiſe in a very great degree *.

* Many diſputes have taken place concerning the action of the heart; ſome referring it to the influence of the

The nervous and vaſcular ſyſtem mutually react on each other; and, therefore, we find it of uſe, in diſeaſe, to attend to the ſtate of the veſſels; becauſe, as the changes induced on them are ſome of them of a mechanical nature, we can more eaſily detect them than the nicer alterations in the action of the nervous ſyſtem, were we to confine our attention to that ſyſtem alone. The ſtate of the pulſe, then, is of importance to be attended to,

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nerves, and others of a vis inſita. If I have been right in my poſition, that the energy is univerſally diffuſed and inherent in every part of the nervous ſyſtem, I apprehend that the arguments in ſupport of the exiſtence of a vis inſita will not have much weight. This controverſy is to be found ſtated in Haller's Elementa Phyſiologiæ, tome I.

Praxagorus referred it to a vis pulſifica, or peculiar pulſatory power; others to an innate heat, which rarified the blood, whilſt the air cooled it, and that this alternate operation produced pulſation; others aſcribed it to fermentation.

and will lead us to aſcertain the preſence, and ſometimes the nature, of many morbid actions and deviations.

There are ſeveral parts of the vaſcular ſyſtem, by the action of which, individually, the pulſe may be affected. The heart, and great artery, the ſmaller arteries, and the veins, all influence the pulſe; and it is eaſy to aſcertain to what degree any of theſe parts operate.

The heart is the origin of motion, and gives to the pulſe its particular feeling, with reſpect to motion, ſuch as regularity, frequency, ſlowneſs, intermiſſion, fluttering, &c. *

* Theſe particular ſtates of the pulſe always depend upon the heart. In all increaſed actions of the living principle, the heart is affected, and contracts oftener. In all inſtances where the heart is affected locally, we have irregular contractions or intermiſſions, as we find to be the caſe in ſpaſ-

The arteries act partly by their elasticity, and partly by their muscular power: The muscular power is greatest in the smaller arteries, and the elasticity in the larger; the one diminishing as the other increases: The aorta is the most elastic, and the least muscular; and, therefore, its action depends chiefly upon that of the heart, to which it is to be considered as an appendage: The action of the smaller arteries, again, depends much upon their own contracting power; but not entirely on this; for the elasticity of their coats likewise operates, unless the artery be very small, in which case it has no elasticity.

There are, then, in the arteries of the

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modic affections of the heart, or its great vessels, malconformation of the heart, diseases of the aorta, or pulmonary system, &c.

arm, for inſtance, two cauſes, operating in producing and influencing the pulſe: Firſt, the elaſticity of the artery; and this cauſe is affected by the heart: Second, the muſcular contraction of their coats; and this is affected only by their own condition, independently of the force of the heart. As the heart, then, gives to the pulſe its particular feeling, with reſpect to motion, ſo does the contraction of the artery give to it the particular feeling, with regard to ſize and quickneſs of contraction, producing the conditions of fulneſs, ſmallneſs, hardneſs, ſoftneſs, &c.

The veins, like the arteries, act partly by elaſticity, and partly by muſcular contraction; but the order is reverſed in them; for the greateſt veins ſeem to have moſt muſcular action, whilſt the ſmall ones have none, or almoſt none.

THE auricles of the heart belong to the veinous ſyſtem, and the ventricles to the arterial. The action of theſe two parts of the heart is alternate; and, therefore, the action of the arteries and the veins is likewiſe alternate, the one dilating, whilſt the other contracts. In health, the action of the veins and arteries correſpond exactly, and a regular and equable circulation of the blood is kept up; but, in diſeaſe, they often diſagree, at leaſt in the commencement of the diſeaſed action; for the veins are leſs irritable than the arteries, and are longer of being affected *.

* External heat, and many other agents, induce a fulneſs of the veins for a time, until the equilibrium be reſtored; and, in many inſtances, we feel the accumulation of blood in the larger and internal veins. This ſtate is often attended with a ſmall quick pulſe, marking a contracted ſtate of the arterial ſyſtem. The ſkin is pale, and the body often appears to be ſhrunk, as we ſee in the commencement of febrile diſeaſes.

There are, then, three caufes which affect the pulfe; and, by attending to the ftate of the vafcular fyftem, we may afcertain the proportion in which thefe operate, in any particular cafe: Firft, the heart and aorta; fecond, the branches of the aorta, or arteries of the body; third, the veinous fyftem.

A healthy pulfe contracts flowly and regularly, and the pulfations do not exceed about feventy in the minute: We feel the artery rifing foftly againft the finger, with a moderate degree of fulnefs. In difeafe, the pulfe becomes either flower, or more frequent, full, fmall, hard, weak, or ftrong *. Thefe condi-

* Practical writers have admitted of an almoft infinite variety of pulfes, which are now believed to be, in a great degree, imaginary, and therefore are overlooked. As a fpecimen of this, I fhall only fubjoin an extract from the

tions it is impossible here fully to describe. I shall, however, keeping the general observations already made in remembrance, make one or two remarks upon some particular states of the ulse.

Compend. Med. of De Gorter, who, although he enumerates many distinctions, which we now set aside, yet has not given the third part of what many others mention.

" Si cor singulis ictibus majori vi contrahitur, sanguis celeriori impetu in latera arteriarum ruens eas dilatat solito magis, quæ dilatatio digitis percepta, si non multo major solito, *robustus fortisque pulsus* dicitur et *validus;* notans cordis vigorem, et copiam sanguinis singulis ictibus ejecti: in morbis bonum præsagium, nisi ob cerebrum compressum ut in apoplecticis, et contusione cranii, animi deliquio scorbuticorum, aut ob compressionem notabilem rami arteriosi hujusmodi fiat pulsus.

" *Vehemens* autem pulsus, digitos veluti removens ab arteria, nec quiescens fortiori digitorum compressione, ut in sanis fieri solet, fortissimam cordis contractionem, quà spiritus consumuntur, et motum humorum velocissimum solida destruentem indicat. Omnia ergo mala, quæ ex his fieri solent, præsagit, et videri possunt in aucta circu-

In all cafes where the pulfe becomes fuddenly fmall, we may infer, that the

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" latione. In morbis acutis inflammatoriis et eryfipelatofis
" obfervatur.

" Quando arteria inftar chordæ tenfæ dura, contra digitos " attollitur, *Durus* dicitur pulfus, fortem indicat arteriæ " impletionem, cum impedito tranfitu fanguinis per arteriæ " extrema, membranarum internarum, ut pleuræ, et menin- " gum, inflammationi comes. Si arteriæ fimul conftringun- " tur magis, eft durus et parvus: alias durus et magnus, " qui melior: præfagia ex inflammatione, febreque acuta " ardente petenda.

" Si, 1*mo*, cordis conftrictio imbecillis fit. Ut in cerebri " compreffione phreniticorum, lethargicorum, delirantium, " tetanicorum, foporoforum, vel ex defectu fpirituum in " perinfirmis, morbis vehementiffimis vires corporis fuperan- " tibus. 2*do*, Si intercipiatur fluxus fanguinis ad cor, ut in " peripneumonia, tuberculo pulmonum, pleuritide validiffi- " ma, fufficientem pulmonis explicatione inhibente; vel per " hepar eo fc. obftructo, aut inflammato, vel nimia quanti- " tate fanguinis evacuata extra corpus, vel collecta in cavis, " aut vafis dilatatis, ut in hydropicis, empyricis: humoris " nimia evacuatione, a partu, ruptioneque vaforum interna. " 3*tio*, Laxatus tonus folidorum in fcorbuticis, hyftericis, " ftomachi debilitate laborantibus, rachitide, in parte para- " lytica, leucophlegmaticis, doloribus flatulentis, 4*to*, in-

proper balance no longer exiſts betwixt the veinous and arterial ſyſtem, but that

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" flammatio et febris ardens, in gangrænam vel ſphacelum " abiens. *5to*, In principio invaſionis febrium, pulſus mi- " nori vi digitos applicatos percutit et attollit, et a com- " preſſione eorum paulo majori omnino ſuffocari poteſt ; " pulſus hic debilis dicitur a Medicis. Quandoque talis " videtur fieri, ſi multa pinguedine vel tumore aquoſo arte- " ria tecta ſit. Talis pulſus, quia arteria minus attollitur, " *humilis* ; minus percipi poteſt, *obſcurus* ; arteriam minus " dilatat, *exilis*, *gracilis*, *exiguus*, *parvus* ; minus implet, *va-* " *cuus* ; tandem in ſummo gradu *deficiens* et *deletus* dicitur, " quorum omnium cognitio et prædictio ex his clara.

" Alterum quod in ſingulis pulſibus animadvertitur, eſt " celeritas et tarditas. Celeritas pulſuum, quamvis a mul- " tis Celeritas cum frequentia confundatur, omnino diſtin- " guenda videtur, intelligimus enim per celeritatem, ſi ab " initio dilatationis uſque ad integram, et ab ea iterum ad " quietem, minori temporis ſpatio peragitur, quam in ſanis " pulſibus fieri debet ; quod exploratione digitorum facile " percipiendum. Si vires deficiunt cum humorum defectu, " atque quodam ſtimulo irritante, cor minimo momento, " veluti ictitans, ſe contrahens, citiſſime dilatat arteriam " brevi tempore ſubſidentem. Ut plurimum in cholera, " febre et temperamento bilioſo, atque febre eryſipelatoſa " obſervatur. Dicitur etiam velox et ictitans quandoque.

the one is acting more than the other. We are not to infer from this ſtate of the

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" Huic oppoſitus eſt, qui vocatur *tardus* et *lentus*, in viſ-
" ciditate humorum frequens obſervatur, ut in cachecticis,
" ſcorbuticis, leucophlegmaticis, quod ob ſanguinis lento-
" rem longius tempus inſumatur, antequam integre arteria
" impleri poteſt, et cor evacuari.

" Cordis actio in pluribus pulſibus aut frequentius, aut
" rarius exercetur. Quæ pulſationes inter unumquemque
" ictum brevius ſpatium temporis relinquunt, ſeu ſi eodem
" temporis ſpatio ſæpius pulſant, pulſus dicitur frequens, a
" quibuſdam celeris et velox dictus, ſed perperam, indicat
" cordis frequentiorem contractionem. Quod fit, 1*mo*, ab
" irritatione phlogiſtica, ut in pleuritide, phrenitide, et
" membranarum inflammatione, quando et *frequens* et *durus*:
" 2*do*, A materia acri bilioſa, ut in febribus bilioſis et ery-
" ſipelatoſis et *frequens* et *celer*. 3*tio*, Defectu virium, ut
" in principio invaſionis febrium, et circa ſtatum, quando
" peſſimus, phthiſicis, perinfirmis, et ſimilibus et *frequens* et
" *debilis*; ſi vero, 4*to*, vires adaugeantur, ut ex uſu Chaly-
" bis in chloroſi, ſingulis ictibus corde majorem copiam
" ſanguinis ejiciente, pulſus fit *frequentior* et *major*.

" Huic contrarius eſt, qui longiori intervallo vibrat, *ra-*
" *rus* dictus, a multis etiam lentus et tardus, quamvis talis
" ad præcedens genus potius pertineat. Blandum indicat
" humorem, hoc ſi ex humorum optabili indole provenit,

pulſe, any thing with regard to the quantity of blood in the ſyſtem; nor are

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" vaſiſque apertis, magnitudine compenſatur parvitas. Ve-
" rum ſi ob viſciditatem, cerebrum aut cerebellum obſeſſum
" tenentem, ut in pituitoſis, leucophlegmaticis, catarrho
" ſuffocativo, ſyncope, et ſopore, atque catalepſi laboranti-
" bus, fiat rarus et parvus aut debilis, ſummum periculum
" imminet, totum cerebellum obſtructum iri.

" Præter cuncta hæc pulſuum genera, qui æquales dicun-
" tur, aliud eſt quod inæquales continet, 1*mo*, in unoquo-
" que ictu, et 2*do*, in multis ſimul. Omnes hi pulſus nun-
" quam quidquam boni indicant, non ſemper tamen mortis
" indicium: quibuſdam enim ſatis familiares, in pulmonum
" morbis et ſcorbuto frequentes, et in quibus poſt mortem
" in corde polypus fuit inventus, aut pericardium cordi ad-
" natum.

" Pulſus ſingulis ictibus inæqualis, tribus ad minimum
" digitis dignoſcendus, et qui cum aliqua duritie percipi-
" tur, *ſerratus* a Medicis dicitur. Indicat magnam cordis
" conſtrictionem, et inæqualem et variis in partibus arteriæ
" reſiſtentiam. Idem imo pejora, ut pulſus durus præſagit.

" Si ſatis magna ſanguinis quantitas e corde pulſa arte-
" riam non nimis reſiſtentem undæ ad inſtar ſucceſſive attol-
" lat, *undoſus* vocatur: talis obſervatur in humorum abun-
" dantia, morbiſque acutis et inflammatoriis, ſi criſin per
" ſudorem natura moliatur, et quando in ſuppurationem

we to ſuppoſe, that the blood neceſſarily circulates ſo faſt through the lungs, as

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"abeat; in morbis autem Chronicis materiam alicubi hærentem in ſanguinem receptam eſſe indicat.

"Si cor minori vigore contrahitur, et ſingulis ictibus inæqualiter, minor quantitas e corde in arterias mittitur, qua arteria ſucceſſive attollitur, ac ſi vermis ſub digitis ſerperet, *vermicularis* pulſus dicitur.

"Qui minorem adhuc vim cordis, et quantitatem ſanguinis indicat, ſimili modo *formicans* appellatur.

"Sed vero qui verſus cor magis: et verſus extrema minus dilatatur, quod cor non valeat, vel deficiat tantus liquor, ut tota arteria impleatur, μύουρος ex ſimilitudine caudæ muris a veteribus dicitur. Qui omnes in omnibus morbis periculoſi ſunt habendi pulſus.

"Qui pulſus pluſquam ſemel videntur attolli, et digitos ferire, *Dicroti* vocantur ſi ſimul debiles; verum ſi magis robuſtus, Caprizans appellatur, raro niſi in perinfirmis obſervatur, et agone mortis.

"Huic quoque referendus *vacillans* et *tremens*, inæqualem et inordinatam arteriarum impletionem indicans, ex denominatione facile definiendus; vires vitæ fragiles et caducas indicat.

"Inæqualium alterum genus duas continet ſpecies, 1*mo*, *Intermittentem*, qui una alterave vice intercalatur ſeu deficit; in membranarum inflammatione gangrænam indicat.

we would at firſt ſuppoſe; becauſe, if there be an accumulation in the veinous

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" in acutis peſſimus, in pueris vero dormientibus, plethori-
" cis, ſenibus, præſertim mulierculis familiaris, et quibus
" cor pericardio accretum eſt.

" *2do*, Μυȣρον, qui ſingulis ictibus minor ſentitur, ut in
" moribundis, quem iterum ulterius ſine neceſſitate in de-
" curtatos, reciprocos, et recurrentes diſtinguunt.

" Mollis fit pulſus, *1mo*, ſi ſufficienter non impleatur, de-
" fectu ſanguinis, ut in peripneumonia, aliiſque pulmonum
" morbis, atque hepatitide, qui tunc ſemper malus. *2do*,
" Arteria nimis laxata, ut in ſcorbuto, leucophlegmatia,
" quando malus. *3tio*, Minori influxu ſpirituum, ut in qui-
" ete corporis et ſomno, bonum indicat; ſed in ſopore, ce-
" rebri oppreſſionem. *4to*, Sedato impetu ſpirituum in fi-
" bras motrices, cum corporis viribus auctis, et pulſus ple-
" nitudine, bonus in febribus.

" Quantitas humorum in corpore contenta, et ſingulis
" ictibus e corde in arteriam ejecta, pulſum *magnum*, *ple-
" num*, *altum*, *latum*, *manifeſtum* exhibet, et palpitationem.
" Qui boni, niſi fiant a nimia copia humorum, vel impedito
" transfluxu ſpirituum per cerebrum, ut in apoplexia, le-
" thargo, phrenitide: vel ab obſtructione rami notabilis ar-
" teriæ.

" Sed ſingulis cordis ictibus minor quantitas in arterias
" derivata, pulſum *parvum*, *vacuum*, *gracilem*, *obſcurum*, *debi-*

ſyſtem, the ſame quantity will not paſs through the lungs, at each contraction of the heart, as paſſed in health; and, therefore, more will not neceſſarily paſs in a given time.

We are not always, from a ſmall pulſe, to infer, that the perſon is very weak, and requires cordials. On the contrary, whenever this ſtate of the pulſe is conjoined with a hardneſs, we may purſue a contrary plan, and detract blood; becauſe the ſmallneſs and hardneſs of the pulſe depends upon the complete contraction of the coats, and marks an action very greatly increaſed, and which muſt ſoon kill, if it be not checked. By opening a vein, we render the

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" *lem*, et etiam *deficientem*, facit; hoc ſi fiat defectu virium, " ut in ſphacelo, catarrho ſuffocativo, ſyncope, infirmitate, " defectu ſanguinis, valde malum: ſed in obeſis, arteria " multa pinguedine tecta, nil mali indicat."

pulſe ſlower, ſofter, and fuller, as we ſee in abdominal inflammation. Whenever there is an increaſed contractile power, producing hardneſs, we may infer the exiſtence of an action, in ſome part of the ſyſtem, of an inflammatory nature, and will often be led to bleed, from this mark alone, when, from other circumſtances, we would deem veneſection improper.

In general, the pulſe is ſmaller and harder in inflammation, in proportion as the ſyſtem is affected; and hence we may, from its ſmallneſs, judge of the danger. In inflammation of the lungs, we have ſeldom, except in robuſt and plethoric people, a full pulſe; at leaſt, if the inflammation be very acute. In inflammation of the brain, the pulſe is likewiſe hard, and ſeldom full; though the ſtate of the pulſe is not ſo often uniform in

phrenitis ; for great variations take place in this diſeaſe. In gaſtritis, the pulſe is very ſmall, and quick. The ſame is the caſe in inflammation of the ſmall inteſtines ; but it is rather fuller, when the great inteſtines alone are affected, and inflammation in them is not ſo dangerous. In cuticular inflammation, the pulſe is fuller, but, of conſequence, proportionally ſlower.

If we are not to be miſled by a ſmall, neither are we to be deceived by a full pulſe ; for this is often felt, even very near diſſolution *. In theſe caſes, the artery is contracting very feebly, and is approaching to the nature of a vein. In dangerous apoplexies, the pulſe is

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* In acute diſeaſes, it is a very bad ſign to find the pulſe full, and the beat *very* frequent ; for this marks, that the artery is unable fully to contract : We feel a vibration, rather than a contraction.

likewiſe often full, from the diminiſhed power of the artery.

WHEN the pulſe is very weak, and very ſlow, we may infer, that the general action of the ſyſtem is much diminiſhed, and that ſyncope, or death, is at hand; for, immediately before death, we find a conſiderable interval betwixt the feeble contractions of the heart.

A SLOW pulſe, conjoined with local pains, ſhows, that no inflammation is preſent, but that the ſenſation proceeds from a different cauſe, often a convulſive action of the part.

THE ſtate of the ſtomach, and abdominal viſcera, influences the circulation greatly, producing, very frequently, a remarkable ſlowneſs of the pulſe.

Deviations, in the function of circulation, are not to be confidered as difeafes in themfelves, unlefs they depend upon fome local affection of the organs of circulation; and, therefore, we are not always to direct our remedies to the removal of thefe alterations alone: On the contrary, we more frequently attend to them, as marks, by which we may know what kind of action is going on. If, however, the difeafed action be very much connected with the circulation, (as inflammation,) we attempt the cure by remedies directed to the vafcular fyftem, the ftate of which is one chief and dangerous fymptom of the difeafe.

We have feveral methods of affecting the vafcular fyftem; fuch as, cold, bleeding, fweating, ftimulants, &c.; and thefe are to be employed with two views:

First, to reſtore the balance between the veinous and arterial ſyſtem, when this is deſtroyed ; and, for this purpoſe, ſweating is the beſt remedy which we can employ: Second, to obviate ſome particular conditions; ſuch as, weakneſs, hardneſs, frequency, &c.; and, for this purpoſe, we muſt apply the appropriate remedies; ſuch as, cordials, bleeding, &c.; or, if poſſible, remove the cauſe.

Of the Equilibrium of Action, and Sympathy.

HAVING proceeded thus far in the account of the living principle, and having mentioned, that it is diffuſed, in an equable degree, over the whole body *, I may next obſerve, that, in a

* Although I maintain, that the vital energy is diffuſed, in an equable manner, over the whole body; that is, each

ſtate of health, the action of each part is proportioned to that of the reſt, the whole acting equally. All the body is ſympathetically connected together, and dependent, the one part upon the reſt, conſtituting a general ſympathy: But ſometimes we find particular parts more intimately dependent upon each other, than upon the reſt of the body, conſtituting a particular ſympathy. Action cannot be greatly increaſed, in any one organ, without being diminiſhed in ſome other; but certain parts are more apt to be affected, by the derangement of particular organs, than others; and it was the obſervance of this fact, which

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part having as much, in proportion to its neceſſities, as another; yet I do not mean to ſay, that each part poſſeſſes abſolutely the ſame quantity: The reverſe is the caſe; but each part is, in health, as perfectly ſupplied with it as the reſt, conſidered with regard to its own functions and demand.

gave foundation to the old and well-known doctrine of ſympathy *, which was ſaid to proceed, "tum ob communionem et ſimilitudinem generis, tum "ob viciniam †."

It may be thought, that this poſition,

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* Many ridiculous explanations were given, of the conſent of one part with another; ſuch as, ſimilarity of intimate ſtructure, anaſtomoſis of blood-veſſels, connection of nerves, &c. The theory which Hippocrates had of ſympathy, is to be found in his book, De Locis in Homine: "Corpus porro ipſum ſibiipſi idem ac ſimile eſt, et ex "iiſdem compoſitum eſt. Similiter autem habet et parvas "et magnas partes, itemque infernas ac ſupernas. Et, ſi "quis minimam corporis partem acceptam male afficere "velit, totum corpus affectionem ſentiet, qualiſcunque "tandem ea fuerit; propterea quicquid tandem minima "pars pertulerit, ad gentilitatem refert ac transfert, una- "quæque ad ſuam, ſive bonum ſive malum id fuerit; et "propterea, corpus et dolet et lætatur cum minima gente, "quia in minima omnes inſunt partes, et hæ ad gentiles "ſibiipſis ſingula transferunt, et omnia denunciant."

† Laurentii Opera, p. 323.

of action being diminiſhed in one organ, by its increaſe, either in the reſt, or in ſome other part, is contradicted, by the exiſtence of general diſeaſes, or actions, affecting the whole ſyſtem: But, in them, we find, in the firſt place, that there is always ſome part more affected than the reſt. This local affection is, ſometimes, the firſt ſymptom, and affects the conſtitution, in a ſecondary way, either by the irritation which it produces, or by an extenſion of the ſpecific action. At other times, the local affection is coeval with the general diſeaſe, and forms a part of the direct effect of the exciting cauſe which produced the derangement. In the firſt caſe, the general diſeaſe is called ſympathetic; in the ſecond, idiopathic. We obſerve, in the ſecond place, that, as there is ſome part which is always more affected than the reſt, ſo alſo is there ſome organ which has its action,

in confequence of this, diminifhed lower than that of the reft of the fyftem, and, moft commonly, lower than its natural ftandard. From the extenfive fympathy of the ftomach, with almoft every part of the body, we find, that this moft frequently fuffers, and has its action diminifhed, in every difeafe, whether general or local, provided that the difeafed action arifes to any confiderable degree. There are alfo other organs, which may, in like manner, fuffer, from their affociation or connection with others which become difeafed, as will be immediately explained. Thus, for inftance, we fee, in the general difeafe called puerperal fever, that the action of the breafts is diminifhed, by the increafed inflammatory action of the uterus.

In confequence of this balance of ac-

tion *, or general connection of the system, a sudden pain, consequent to violent action of any particular part, will so weaken the rest, as to produce fainting, and, occasionally, death. But this dependence appears more evidently, in what may be called the smaller systems of the body, or those parts which seem to be more intimately connected with each other, than they are with the general system. Of this kind is the con-

* The theory of a balance, of any kind, existing in the system, was first, I believe, decidedly pointed out by the late Dr. Irvine, whose chemical knowledge has deservedly raised his name high among the philosophers of Europe: But he only imagined, that a balance of sensibility or sensation exists in the body, which is a doctrine very different from the present, which supposes a balance of action. The ancient and common doctrine of sympathy, was very different from this, which I have attempted to establish; because it was believed, that the part sympathising became affected with a disease, similar, or nearly similar, to that of the part originally injured.

nection of the breafts with the uterus of the female; of the urethra with the tefticles of the male; of the ftomach with the liver; of the inteftines with the ftomach, and of this again with the brain; of the one extremity of the bone with the other; of the body of the mufcle with its infertion; of the fkin with the parts below it.

Of thefe fmaller fyftems, or circles, I fhall treat regularly; but, firft, it may be proper to obferve, that thefe are not only intimately connected with themfelves, but alfo with the general fyftem, an univerfal fympathy being thus eftablifhed.

That there is a very intimate connection between the breafts and uterus, has been long known, but it has not

been very ſatisfactorily explained. Fallopius, and all the older authors, declare plainly, that the ſympathy is produced by an anaſtomoſis of veſſels; Bartholin adding, that the child being born, the blood no longer goes to the uterus, but is directed to the breaſts, and changed into milk. But none of all thoſe who talk of this derivation aſſign any reaſonable cauſe which may produce it.

In pregnancy, and at the menſtrual periods, the uterus is active; but, when the child is delivered, the action of the uterus ſubſides, whilſt the breaſts, in their turn, become active, and ſecrete milk. If, at this time, we ſhould again produce action in the uterus, we diminiſh that of the breaſts, and deſtroy the ſecretion of milk, as is well illuſtrated by the caſe of inflammation of the uterus, which is

incident to lying-in women *. When the uterus, at the ceſſation of the menſes, ceaſes to be active, or to ſecrete, we often find, that the breaſts have an action excited in them, becoming ſlowly inflamed, and aſſuming a cancerous diſpoſition. The uterus and breaſts ſeem to be a ſet of glands, balancing each other, in the ſyſtem, one only being naturally active, or ſecreting properly, at a time; and, accordingly, we ſeldom, if ever, find, that, when the uterus yields the menſtrual diſcharge, the milk is ſecreted in perfection, during the continuance of that diſcharge; nor do we ever find them both inflamed at the ſame time.

The uterus has not only this connec-

* In puerperal fever, when the uterus becomes inflamed, the ſecretion of milk diſappears, until the action of the uterus ceaſes. See the Anatomy of the Gravid Uterus, p. 73.

tion with the breaſts, but it has alſo a very particular ſympathy with the ſtomach, which again ſympathiſes with the brain; and thus we ſee how a diſorder of the uterus may induce an extenſive ſeries of affections, each dependent on the other *.

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* When the uterus has its action increaſed, at the menſtrual period, the ſtomach is often much affected, and, alongſt with it, the brain, and whole nervous ſyſtem, producing hyſteria. There is, at this time, every ſymptom of weakened ſtomach; ſuch as, vomiting, belching, and, not unfrequently, ſpaſmodic contractions. This ſtate of the ſtomach will, in its turn, affect the brain, in the ſame way as it does after a debauch, or in violent dyſpepſia; that is to ſay, it will produce head-ache or dizzineſs. This affection of the head is not the immediate conſequence of the action of the uterus, but depends upon the diſeaſe of the ſtomach, induced by the uterus. Thus we ſee that organs may come to ſuffer, by the derangement of a particular part, although they do not directly ſympathiſe with that part. A recollection of this may be of uſe in inveſtigating the nature of ſome complicated diſeaſes.

THE uterus has been known, ever ſince the foundation of phyſic, to produce very extenſive diſeaſe in the nervous ſyſtem; and it is amuſing to hear how this was explained. The diſeaſe, called "Suffocation of the Uterus," with many other hyſterical ailments, were attributed to the ſwelling or choaking up of the uterus, by winds and vapours generated from the retention of the menſes, or by the corruption of the ſemen, and putrefaction of the bad humours, which came there to be diſcharged; for this organ was conſidered by many as a common cloaca*. Theſe "ventoſities" being once generated, it was believed, that they mounted up to the ſtomach, the liver, and, at laſt, to the brain. The cure conſiſted in expelling

* "Cette partie eſt comme un cloaque ou ſont envoyez "tous les excrements du corps." *Ambroſe Paré.*

these; and one of the remedies which was employed, for this purpose, was warm aromatic fumes, conveyed, by tubes, to the os uteri; for there was no safety, they imagined, until this vile stuff was discharged; this "occult odour," as Van Helmont calls it.

The organs of generation, in the male, form likewise a little system, in which all the parts exhibit this sympathy with each other. They likewise give us a very good instance, of the association of action, or sympathy, in the common acceptation of that word.

Sympathy has been divided into the contiguous, where parts become affected from vicinity, and the remote, where a distant part becomes affected. It will be more conformable to the present doctrine, which I apprehend to be true, to

divide it into, firſt, the *ſympathy of equilibrium*, in which one part is weakened, by the increaſed action of another; and, ſecond, the *ſympathy of aſſociation*, in which two parts act together, at the ſame time.

The ſympathy of aſſociation is produced ſuddenly, and for a ſhort time: The ſympathy of equilibrium is produced more ſlowly, and continues to operate for a much longer time.

It is curious enough, that moſt, or, at leaſt, many of thoſe organs, which ſeem to be connected by the ſympathy of equilibrium, exhibit likewiſe more or leſs of the ſympathy of aſſociation, when under the circumſtances in which this can take place.

The ſympathy of equilibrium is ſeen

in the effects of inflammation of the end of the urethra, on the testicle, which often diminishes its action, and produces a very disagreeable sensation of dullness; or, if this inflammation be suddenly diminished, the action of the testicle is as suddenly increased, and swelling takes place. The same is seen in the connection of the urethra with the bladder and prostate gland, as will be more fully mentioned in the dissertation on gonorrhœa. These parts, likewise, affect the stomach greatly, increased action in them weakening that organ much*. This is

* The effects of excessive venery, in producing dyspepsia, and, consequently, gout, is very well known. Unless this cause be removed, it is impossible for patients ever to recover from diseases of the stomach. Lord Chesterfield mentions, that when he consulted Boerrhave, that celebrated physician added, by way of a note to his prescription. "Venus rarius colatur." Letter cxxx.

ſeen in the effects of ſwelled teſticle, or exceſſive venery, or inflamed bladder, or irritation of the bladder, from a ſtone; all which weaken the ſtomach, and produce dyſpepſia. The ſame remark applies to the kidney; vomiting and flatulence being produced by nephritis.

THE ſympathy of aſſociation, or an inſtance of ſympathy, in the common acceptation of the word, is likewiſe ſeen in the connection betwixt the glans and teſticles, in coition; but, for this purpoſe, the action in the glans muſt be ſudden, and of ſhort duration; for, if continued long, weakneſs of the teſticles, or diminiſhed action, is induced*. In

* It is on this principle, that, if emiſſion does not take place quickly, in coitu, it either does not take place at all, or with difficulty. If the ſtate of the glans be ſuch, as to prevent a ſudden and great action, in that part, no emiſſion follows; and this is one cauſe of impotence

thoſe parts which exhibit this natural aſſociation of action, if the action of one part be ſuddenly, and for a ſhort time, increaſed, the action of the ſympathiſing part will likewiſe be increaſed, as we ſee, in the inſtance already given, of coition, and likewiſe in paroxyſms of the ſtone, in which the glans penis, after making water, becomes very painful. But, if the action be more ſlowly induced, and continued for a long time, then this aſſociation is ſet aſide, by the ſtronger and more general principle of the equilibrium of action, and the ſympathiſing part is weakened. Hence, violent inflammation of the end of the urethra, produces a weakneſs and irritability of the bladder, dullneſs of the teſticles, &c.

THERE is alſo an evident ſympathy of equilibrium, betwixt the ſtomach and

lower tract of inteſtines, which two portions may be ſaid, in general, to balance each other, in the abdomen. When the action of the inteſtines is increaſed, in diarrhœa, the ſtomach is often weakened, and the patient tormented with nauſea. This will be cured, not ſo eaſily by medicines taken into the ſtomach, as by anodyne clyſters, which will abate the action of the inteſtines. When the inteſtines are inflamed, as in ſtrangulated hernia, vomiting is a never-failing attendant: When, again, the ſtomach is inflamed, the inteſtines are affected, and obſtinate coſtiveneſs takes place *. Even

* It might be thought, that, as inflammation of the inteſtines produces nauſea or vomiting, ſo gaſtritis ought to be attended, uniformly, with looſeneſs. But it is to be remembered, that the ſame cauſes produce very different effects on different parts. What produces mortal ſickneſs in one part of the alimentary canal, occaſions violent pain

in hyſterical affections of the ſtomach, the inteſtines are often deranged. Injections of cold water frequently relieve theſe affections of the ſtomach, by their action on the inteſtines.

The liver and ſtomach are alſo connected with one another. When the liver is inflamed, or has its action increaſed, the ſtomach is weakened, and dyſpeptic ſymptoms take place. When the ſtomach is weakened, as, for inſtance, by intoxication, then the action of the liver is increaſed, and a greater quantity than uſual of bile is ſecreted. The ſame

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in another; and the ſenſation and conſequence of diminiſhed action is different in different parts. Dyſpepſia produces ſqueamiſhneſs in the ſtomach; but the ſame cauſe, affecting the inteſtines, occaſions coſtiveneſs.

Gaſtritis may be accompanied with looſeneſs; but, in this caſe, there muſt be ſome irritating cauſe in the inteſtines.

takes place in warm climates, where the ſtomach is much debilitated. If the liver has its action thus frequently increaſed, it aſſumes a ſpecies of inflammation, or becomes, as it is called, ſchirrus. This is exemplified in habitual dram drinkers, and in thoſe who ſtay long in warm countries and uſe freedoms with the ſtomach. The liver likewiſe ſympathiſes with the brain; for when this organ is injured, and its action much impaired, as in compreſſion, inflammation and ſuppuration have been often known to take place in the liver*.

Besides this connection of the ſtomach with the liver, it is alſo very intimately dependent on the brain, being weakened when the action of the brain is increaſed, as we ſee in inflammation

* Mem. de L'Acad. de Chirurg. Tom. III.

of that organ. The brain, again, is affected with pain, when the ſtomach is weakened by intoxication, or other cauſes; and this pain will be often relieved by ſlowly renewing the action of the ſtomach by ſuch ſtimuli as are natural to it, ſuch as ſmall quantities of ſoups frequently repeated. A ſlight increaſe of action in the ſtomach, at leaſt if not of a morbid kind, affects the brain ſo as to produce ſleep, diminiſhing its action. This we ſee in the effects of a full meal, and even of a draught of warm water. The ſtomach likewiſe ſympathiſes with the throat, ſqueamiſhneſs and anorexia being often produced by inflammation of the tonſils. This inflammation is frequently abated by reſtoring or increaſing the action of the ſtomach. Hence the throat, in ſlight inflammation, is frequently eaſier after dinner: Hence, likewiſe, the effect of emetics in cynanche.

The extremities of bones and muſcles alſo ſympathiſe in the ſame manner. When one end of a bone is inflamed, the action of the other is leſſened, and pain is produced *; for a painful ſenſation may reſult both from increaſed and diminiſhed action. When the tendon of a muſcle is inflamed, the body of that muſcle often is pained; and vice verſa.

Lastly, the external ſkin ſympathiſes with the parts below it. If it be inflamed, as in eryſipelas, the parts immediately beneath are weakened, or have their natural action diminiſhed. If this inflammation affect the face or ſcalp, then the brain is injured, and head-ache, ſtupor, or dilirium mite, ſupervene. If it attack the ſkin of the abdomen, then the abdo-

* To give only one example; in morbus coxarius, the knee is painful.

minal viſcera are affected, and we have vomiting and purging, or obſtinate coſtiveneſs, according to circumſtances, as explained in a note to a former part of the text. This is illuſtrated by the diſeaſe of children, which is called by the women the bowel hive, in which the ſkin is inflamed, as they ſuppoſe, from ſome morbid matter within.

If the internal parts be inflamed, the action of the ſurface is diminiſhed; and, by increaſing this action, we can leſſen or remove the diſeaſe below, as we ſee daily proved by the good effects of bliſters. When the ſtomach, inteſtines, or kidney, have been very irritable, I have known a ſinapiſm act like a charm; and in the deep-ſeated inflammations of the breaſts, bowels, or joints, we know of no better remedy, after the uſe of the lancet, than bliſters. The utility of iſſues, in diſeaſes

of the lungs, the liver, and the joints, is to be explained on the ſame principle. In theſe caſes, we find, that iſſues do little good unleſs they be ſomewhat painful, or be in the ſtate of healthy ulcers. An indolent flabby ſore, however large the diſcharge (which is always thin, and accompanied with little action), does no good, but only adds to the miſery of the patient. We may, however, err on the other hand, by making the iſſues too painful, or by keeping them active too long; for, after they have removed the inflammatory diſeaſe below, they will ſtill operate on theſe parts, leſſening their action, and preventing the healing proceſs from going on properly. This is ſeen in caſes of curvature of the ſpine, where, at firſt, the inflammation of the vertebra is diminiſhed by the iſſues; but if they be kept long open after this is removed, they do harm. We often ſee the patient

recover rapidly, after his surgeon has healed the issue in despair, judging that it could do no farther service, but only increase the weakness of his patient.

It is a well-established fact, that when any particular action disappears suddenly from a part, it will often speedily affect that organ which sympathises most with the part which was originally diseased. This is best seen in the inflammatory action, which, as practical writers have well observed, occasionally disappears quickly from the part first affected, and then shows itself in some other *.

* In the cynanche parotidea, the testicles or breasts often swell in proportion as the inflammation leaves the parotid gland. There are many instances in which the increased action of the parotid gland, in mercurial salivation, has subsided suddenly, and affected the stomach with intolerable irritability. The cessation of the inflammatory action of the urethra in gonorrhœa, and its consequent ap-

From the united testimony of all these facts, I may certainly maintain the doctrine which I proposed to prove, and introduce it into pathological reasonings. In the whole of the animal economy, we discover marks of the wisdom of the Creator; but, perhaps, in no part of it more than in this, of the existence of the sympathy of equilibrium: For, if a large part of the system were to have its action much increased, and all the other parts to continue acting, in the same proportionate degree as formerly, the whole must be soon exhausted, (for increased action would require, for its support, an increased quantity of energy). But, upon this principle, when action is much increased in one part, it is, to a certain degree, diminished in some other. The general sum or degree

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pearance in the testicles, has been already mentioned, and will afterwards be more fully considered.

of action in the body, is thus less than it otherwise would be, and, consequently, the system suffers less.

Of the Actions of the Nervous Energy.

HAVING made these general observations upon the nervous system, I come now to consider, more particularly, its different operations or actions. These, we have seen, are always induced by agents, which are to be considerd as external; and these agents are called stimuli. The action or operation which is produced, depends, first, upon the nature of the stimulus; and, second, upon the property of the nerve *.

* There are many nerves, which have, ab initio, a certain function or property allotted to them, which is excited by the application of some particular or specific stimulus. But, after this peculiar action of the nerve is fully esta-

Every ſtate of the ſyſtem is produced by an operation of the nervous energy; and this operation is called an action.

Almost every ſubſtance produces ſome change upon the ſyſtem; and theſe changes may all be called diſeaſes, if, by this term, we underſtand a condition of the nervous ſyſtem, not entirely the ſame with the natural ſtate.

It has been already mentioned, that the living principle, if not acted on, would exhibit no phenomena; and that, although it ſhould be preſent in any body, we ſhould ſtill, were there no action produced, conclude that body to be dead.

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bliſhed, it is not always neceſſary, for the performance of theſe actions, that the ſpecific ſtimulus be applied. Light, for inſtance, is not always requiſite, for the ſenſation or action of viſion, nor air for hearing; the application of zinc and ſilver, &c. being capable of producing theſe.

The term life, in common language, is applied, not to the living principle, but to its evident operations or actions. Theſe are produced by certain fixed and determinate agents, which act conſtantly, and produce, what is called, the healthy, or natural action, (or, in common language, life). If we apply other agents than thoſe which are natural, we modify or change the action; and, in proportion as the new action differs from the natural one, ſo is it dangerous to the ſyſtem. Theſe actions may be conſidered as different varieties of life, if we uſe this term in its vulgar acceptation; but theſe varieties, or, at leaſt, many of them, not being fitted to our frame, we cannot exiſt long with them, more than we could, were the ſpecific life, or congeries of actions of a quadruped, to be excited in us by any magical power.

It muſt evidently appear difficult, to every one who thinks upon the ſubject, to ſay, how foreign agents operate on the living principle of man, or how a ſmall particle of matter, taken from the bowels of the earth, ſhould excite a dangerous and mortal action of the vital power of an animal. In order, in ſome degree, to explain this, I may obſerve, firſt, that no two inert bodies can act on each other; or, in other words, that matter alone cannot act on matter, unleſs it be poſſeſſed of ſome active power: Neither is it poſſible for an inert body to act on one poſſeſſed of this enlivening principle; for the very capability of producing or exciting action, implies activity. Unleſs, then, both agent and actor poſſeſs ſome property different from mere matter, or matter truly dead, no change can be produced. Were the ſun to loſe its active power, or attraction,

it could no longer act on any of the planets; and were any of the planets to lose their power, they could no longer be acted on by the sun, or by other planets. If, then, it be admitted, which none will deny, that action can only be produced in a body which is alive, and by an agent possessed of an active principle, it will follow, that no action can be excited in an animal, except by means of the active principle of the agent which immediately excites it.

I SHALL, secondly, observe, that, as the vital principle, in animals and vegetables, admits of modifications, in the different individuals with which it is connected, so also does the vital or active principle of common matter; and it is these modifications which produce the essential and characteristic qualities of the different individuals, or different

kinds of matter. Chemiſtry teaches us, that there are not many kinds of matter radically different; and, it is not extravagant to believe, that, were ſcience improved, or, were the whole myſtery of creation unfolded, we might find, that there was only one radical kind of matter, which, by its modification, yielded different products. The ſpecific, or differential qualities of matter, never can be ſuppoſed to depend upon any cauſe, inſeparably connected with mere matter, but muſt depend upon the operation of a diſtinct and active principle. We may mix different ſpecies of matter together, taken from the vegetable or mineral kingdoms; but we ſhall not make a new ſubſtance, unleſs the active principle operate, and become modified, converting the whole into a new individual.

In the third place, I remark, that a

modification of a cauſe muſt produce an alteration in the effect.

From theſe three obſervations, I think we may underſtand, firſt, how foreign agents are capable of acting on the body; and, ſecond, why different agents ſhould excite different actions.

I may further obſerve, that it is only the attractive principle, or life of matter, which operates on animal life, exciting it to action; and it is only in ſo far as living animals, or vegetables, poſſeſs properties in common with common matter, that they can excite action in another animal. Hence, when applied to the body, or taken into the ſtomach, they can only excite the ſimple actions productive of the ſenſation of feeling: But, after the animals, or vegetables, die, that is to ſay, part with their ſpecific life, and be-

come the ſame with common matter, then they can excite peculiar and varied actions; then, but not until then, can they be changed, and rendered uſeful as food, and not until then, do they ever act as medicines.

It is upon the principle now mentioned, of agents, or ſtimuli, acting only on the body, by means of their active principle, that we are to explain the influence of theſe larger maſſes of matter, the ſun and moon, upon the human body. That theſe affect the body, both during health and diſeaſe, has been ſo fully admitted, by ſo many attentive phyſicians *, that I ſhall conſider the fact as eſtabliſhed, and requiring no farther evidence in this place.

* See the Works of Mead, and, more lately, the Obſervations of Jackſon, Balfour, &c.

The operation, or action, of the syſtem, in the healthy ſtate, can ſcarcely be deſcribed; becauſe it comprehends and produces every circumſtance connected with health; ſuch as, ſenſibility, muſcular contraction, abſorption, nutrition, digeſtion, and all the other functions of the body. Theſe operations, taken collectively, may give ſome idea of the natural or healthy action. This action is much too extenſive and intricate to be deſcribed, or defined; but it may be underſtood, by obſerving the general condition of a healthy perſon.

The preſence of this action, ſeems alſo to be requiſite for the ſupport or renewal of the energy which produces it; for, if the action be ſuſpended, or totally changed, the functions ceaſe; all energy is loſt, and death takes place. Whilſt the action, then, depends upon

the power, the power depends, for its continuance, upon the action *. Hence, when agents capable of exciting an action, very different from the natural one, are applied, we may readily perceive, how weakneſs ought to be the

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* We have ſeen, that the vitality of animals is received from common matter, the active principle of which is gradually changed, and rendered more perfect. It is from the life of the blood, that all energy is immediately derived, being, in the brain and nerves, elevated to the greateſt degree of perfection. This is, undoubtedly, the effect of ſome action; for it is not done by any innate quality, inſeparably connected with vitality itſelf; otherwiſe, we might find it raiſing itſelf to different degrees of perfection, in the very loweſt orders of the creation. This action is not ſeated in the blood; otherwiſe, we ſhould find the life more perfect than it is, in the blood; but it is to be found in the nervous ſyſtem, which performs all the actions and operations of the body, by means of a living principle, which, by its operation, enables it to renew the energy, or power. The nerves alone cannot do this; for it implies an active operation, which they cannot perform without life.

consequence: On the contrary, if the natural action be gradually increased, and remain unchanged, strength will be produced *. If, however, the increase of action has been more sudden, and to a greater degree, we find, that it is changed in its nature, and is no longer healthy, as we see in inflammation, in which we have no production of strength, but, on the contrary, an expenditure of power. The same thing happens, when particular functions are increased in their action; such as, muscular motion, secretion, &c.

The nervous system has its energy

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* If, by any means, the energy could be increased, without a previous increase of action, (which, however, is impossible,) we should, in all probability, have an immediate increase of action. Increase of energy, and increase of natural action, singly, ought to produce the same effect.

ſupported, and its healthy actions excited, by arterial blood, which may, therefōre, be called a natural ſtimulus. Heat, air, and food, are likewiſe neceſſary ſtimuli; but theſe all act, either by preparing the blood, or imitating its operation. Food and air give to the blood its moſt valuable qualities; and heat, applied externally, only co-operates with that fluid, which produces it in a certain quantity, by the action of the living ſyſtem.

When other agents operate on the ſyſtem, a different ſtate from that produced by the blood, is induced in the body. Wine, opium, contagions, mercury, &c. being all capable of operating on the ſyſtem, produce an action, which, of neceſſity, muſt be different from the natural action, in as much as theſe agents differ from the natural agent.

New agents sometimes appear to increase the natural action; but this, it is evident, they never can do, without changing or modifying it in some respect *; and, therefore, the opinion, that

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* No agent can excite an action perfectly similar to the natural one, unless it be a stimulus, which is habitually present, such as, arterial blood and heat. Electricity appears to increase the natural action, or whatever action is going on at the time of its application, in the same way with heat; but we cannot call electricity a new agent; for it certainly operates, habitually, on our system, although, as yet, we are much in the dark respecting it.

Those agents which are natural to the system, are found to increase every action which is going on, whether healthy or diseased. Hence, blood and heat will support, not only the natural action, but also any other which has been induced.

This may explain to us the use of heat in medicine, and may also inform us, what effects we are to expect from it. In warm climates, some functions, or parts of the natural action, are increased, beyond that relation which ought to subsist betwixt them and the power, and weakness is produced. All the secretory actions are increased, at least, such as are not incompatible with each other;

they produce diſeaſes, conſiſting entirely of different degrees of ſtrength, or natural action, is abſurd. When any ſtimulus has been applied to a part, ſo as to produce inflammation, it has been ſuppoſed merely to increaſe the vigour of the part, or, in the language of Dr. Brown, to increaſe its ſthenic diatheſis. But the whole ſeries of ſymptoms, in that diſeaſe, ſhow, that a new action is produced, differing very much from the natural one, both in its progreſs and conſequences, as will be evidently ſeen, when we come after-

ſuch as the ſecretion of urine, and ſweat, which cannot both be increaſed in quantity at the ſame time. All morbid actions are increaſed; and hence the danger of diſeaſes in warm climates. The fever is violent, and runs its courſe rapidly: The action in ulcers is far beyond the power, and the deſtruction is great: The contagion of dyſentery acts powerfully, and a few hours decide the fate: Blood, like heat, increaſes actions; and hence the truth of the old obſervation, "That full-blooded people bear diſeaſe worſe than the "ſpare."

wards more fully to examine it. The variolous matter, again, at the ſame time that it induces the inflammatory action, modifies it, and, in a very ſtriking manner, changes its nature.

Some actions appear to ariſe without any evident cauſe, or to be repeated, by what is called habit; but, in order that this may take place, it is neceſſary, firſt, that the action have been, at ſome former period, ſtrongly excited, or long continued, or frequently repeated: Second, that either ſome ſtimulus be applied, which has been frequently applied during the former continuance of the action, and which had been accuſtomed to increaſe it; or, that ſome ſtimulus be applied, which, in its effects, bears a reſemblance to ſome part of the former diſeaſed action, which is thus renewed. Thus, if a perſon has once had an ague,

he is apt to have a return of it, whenever he is expofed to much cold, which induces a ftate fimilar to the former cold fit.

In all morbid actions, we have three periods to attend to :

First, The period of formation, in which the animal is weakened, by the diminution of the natural action, or functions, during the time that the new action takes to form ; for difeafed actions never take place fuddenly, (unlefs the exciting caufe be very powerful, and applied only to a particular part, producing local difeafe), but a certain time is required for their formation. The weaknefs induced in this way, will be obfervable in every general action, and even in thofe which, when fully formed, are called inflammatory. The fymptoms

which take place, during the formation of an action, are lassitude, anorexia, coldness, head-ache, and thirst. These always occur, and precede actions, the most dissimilar one to the other.

SECOND, The period in which the action exists in perfection, and fully formed, marked by the peculiar characters of the action; such as, heat, pain, and redness, in inflammation; eruptions, in the exanthematæ; peculiar indescribable condition in typhus, &c.

THIRD, The termination. All new actions terminate by a secretion. In the inflammatory action, we have either a secretion of matter, similar, or nearly similar, to the natural substance of the part, producing adhesion, or resolution, as it is called; or a secretion of a fluid,

called pus, ſerum *, &c. In many other actions, however, we have no new ſecretion formed, but only an augmentation, and perhaps, ſlight change, of ſome natural and accuſtomed diſcharge; ſuch as, ſweat, urine, or, occaſionally, the inteſtinal mucus. Theſe diſcharges, or ſecretions, are ſometimes in ſmall quantity; but, at other times, they are more conſiderable and evident. By the attentive ancients, they were called critical, as they were often ſeen to occur in the end of the diſeaſe.

ALTHOUGH all actions terminate in a ſecretion, yet it does not follow, that, whenever the ſecretion appears, diſeaſe is

* Pus is the moſt common ſecretion, terminating inflammation; but it may alſo end in a ſecretion of thin fluid, like ſerum, producing a dropſy of the affected part. This is too frequently fatally ſeen in the head and cheſt.

to end. The reverſe is too often the caſe; for, in many ſpecies of inflammation, the ſecretion continues permanent, unleſs we interrupt it by art. In all acute diſeaſes, however, or in thoſe which are called febrile, the ſecretion does not continue permanent; and, in all eruptive actions belonging to this claſs, the action terminates, whenever this ſecretion is completed; and the patient is then ſubject only to the weakneſs which the action may have induced, and to the effects which the eruption, conſidered as ſimple ulcers, may now produce. This is ſeen in the ſmall-pox, chicken-pox, &c. *

Actions are only known and diſtin-

* I have ſeen the meaſles appear, before the puſtules of the chicken-pox were quite gone, which could not have happened, unleſs the general diſeaſe, or peculiar action, had diſappeared, when the ſecretion took place.

guiſhed by their effects; and many of theſe are of ſuch a nature, as not to be cognifable by the ſenſes; ſuch as, the peculiar or ſpecific ſtate of the body, in typhus fever, ſmall-pox, &c. The preciſe nature of theſe conditions, can neither be deſcribed nor underſtood; becauſe they cannot be brought under the examination of any of our ſenſes. Some have, therefore, denied their exiſtence altogether, or have not perceived it.

In almoſt every ſyſtem of noſology, they have been entirely overlooked, the claſſification being founded upon ſuch general and ſenſible deviations, as occur in every action, over and above the peculiar condition; ſuch as, affection of the circulation, pains, eruptions, &c.

Some actions are confined to a particular part of the body, whilſt others af-

ſect the whole ſyſtem; and, therefore, noſologiſts have uniformly ſeparated theſe diſeaſes from each other; and, at firſt ſight, we might conceive, that the primary and great diviſion of diſeaſes might be taken from this ſource. But, by maturer conſideration, we ſhall find that the diſtinction is erroneous; becauſe there is no local diſeaſe whatever, which, if either increaſed in degree, or continued for a long time, will not affect the conſtitution, and induce a general ailment. On the other hand, there is no action which affects every part of the body equally; and, therefore, there is no general diſeaſe without a local one; or, in other words, there is always ſome part of the body, in every diſeaſe, more affected than the reſt. In the exanthematæ, the ſkin is moſt affected; in fevers, ſtrictly ſo called, the head is generally moſt affected, although ſometimes the lungs or

abdominal vifcera fuffer moft. Of all the parts of the body, however, the brain generally is affected in the greateft degree, unlefs the difeafe be induced by fome caufe acting locally on other parts; but, even in this cafe, if the difeafe be violent, an affection of the head is fuperadded to the other local difeafe. This is exemplified, in the cafe of thofe who die after wounds or operations; in which event, the brain is commonly found turgid, and the patient, not unfrequently, is affected with coma before death. In certain difeafes, we obferve a feries of aptitudes of the different parts of the body to be affected, as will afterwards be particularly illuftrated in the venereal difeafe. In all actions, the leaft fenfible parts fuffer lateft. This we fee in the cafe of the bones, tendons, and cartilages.

ACTIONS produce different fymptoms,

according as they are extended over the body. Such as affect the whole ſyſtem, produce undefinable uneaſineſs, frequency of pulſe, heat, and the other ſymptoms of what is called fever. But, when action appears in one part more than the reſt, as it always does, that part is affected with what we call pain; and, if the action be ſtill more increaſed in it, we have a ſpecies of inflammation induced. This is illuſtrated by every diſeaſe which we know of; for, in common fever, in ſmall-pox, and every ſpecific action, we find inflammation produced, whenever action becomes much concentrated in any part *.

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* Inflammation in a part, is intimately dependent on the ſtate of the veſſels. All actions, which produce perceptible diſeaſe, affect the veſſels, making them contract more or leſs frequently, and more or leſs ſtrongly. We may, therefore, ſee how any action, when greatly increaſed in a part, may induce inflammation.

INSTEAD of adhering to the more eſtabliſhed modes of claſſing diſeaſes, it will better anſwer the preſent purpoſe, to divide actions into the ſix following claſſes *.

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* This arrangement will, it is true, bring together diſeaſes, which have often been far ſeparated; and is likewiſe very imperfect, becauſe no more than an outline of the claſſification can be given here. The minuter ſubdiviſions, ariſing from the action being general or local, and from the function, chiefly impaired, or other circumſtances, cannot be noticed in this ſketch. If theſe were inſerted, (which would take more room than can be properly ſpared to it,) many of the imperfections and apparent inaccuracies would diſappear; but no ſyſtem of noſology ever has, and, until our knowledge be increaſed, ever can be free from fault. As for the circumſtance, of bringing together diſeaſes or actions formerly ſeparated, I have only to remark, that the ſame licence ought to be allowed for uniting them, as for ſeparating them, both proceeding on arbitrary or aſſumed principles. In this arrangement, the actions are claſſed, not altogether according to their cauſe, but chiefly according to their evident effects or ſymptoms, which is the moſt uſeful way; the object of medicine as yet being almoſt totally confined to the removal of ſymptoms. To

CLASS I.

A. Naturales.

ALTERATIONS in the performance of the natural action of a part of the body, or of the whole system, but not to such a degree, as materially to change its nature, or render it new *.

Order I. IMPERFECTÆ.—A diminution, interruption, or irregularity of the

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comprehend all the diseases of the human body, another class, consisting of actions of the mind, ought to be added.

* We shall afterwards find, when we come to consider inflammation, that if the whole natural action of a part be much increased, it becomes changed in its nature and effects: But the present class comprehends these changes only, which take place to such a degree, as not to alter the nature, or destroy the characteristic marks, of the natural action.

performance of ſome part, or the whole of the natural action *.

Order 2. ACCRESCENTES.—Some part of the natural action morbidly increaſed, without being materially changed in its nature †.

Order 3. INEQUALES.—A loſs of balance betwixt ſome part of the natural action ‡.

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* This order may be ſubdivided, according as it affects the different functions, &c.; and comprehends ſpaſm, epilepſy, palpitation, aſthma, dyſpepſia, cholic, chloroſis, torpor from cold, &c.

† This will comprehend, cholera, diarrhœa, menorrhagia, &c.

‡ This comprehends the different varieties of dropſy. In this diſeaſe, the ſecretion and abſorption do not balance each other.

CLASS II.

A. Tranſpoſitæ.

A TRANSPOSITION of the natural action of ſome part of the body to another part, which, in health, poſſeſſes a different action.

Order I. FORMANTES.—A tranſpoſition of the action which forms the part *.

* When the muſcle-forming action is loſt in the arteries, and membrane is produced in its place, aneuriſm is the conſequence. When the action of forming bone is tranſferred to the heart, a very ſerious diſeaſe takes place. When the action of the veſſels of the tunica ſclerotica is transferred to the cryſtalline lens, cataract is produced.

Order 2. SECERNENTES.—A tranſpoſition of ſome ſecretory action *.

Order 3. SYMPATHETICÆ. — Actions transferred, by ſympathy, from the diſeaſed part to one which was formerly healthy †.

CLASS III.

A. Similes.

ACTIONS which, when analyſed, are found to bear a reſemblance to the natural action, which is increaſed to ſuch

* There are inſtances recorded, of the purulent ſecretion being transferred to ſome part which formerly was ſound. There are many caſes, where the menſtrual diſcharge has come from different parts of the body.

† This order is founded on the doctrine of the ſympathy of equilibrium, which has been already explained.

a degree, as to become changed in its nature *.

Order 1. INFLAMMATÆ.—Actions producing heat, redneſs, pain, and more or leſs ſwelling, in ſome particular organ, often attended with pyrexia †.

Order 2. STIMULANTES.—A general increaſe of action, (without ſuch a local affection as to produce true inflammation in the part,) marked by frequency of pulſe, heat of the ſkin, thirſt, and pain or confuſion in the head ‡.

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* The change of the nature of an action, from a change of its degree, will be afterwards illuſtrated, in the diſſertation on inflammation.

† This order comprehends the phlegmaſiæ of noſologiſts.

‡ This comprehends the ſlight febrile attack called ephemeræ; the action induced by wine, ſpirits, hartſhorn,

Order 3. SANGUINANTES.—A difcharge of blood from the veffels of a part, without any artificial wound, accompanied with a general action of the fyftem *.

Order 4. TONICÆ.—Actions confifting in an increafed contractile power, nearly, though not entirely, fimilar to the natural action †.

&c. In thefe there is always fome part more affected than the reft; but this fuperior affection muft not be to fuch a degree, as to produce inflammation; otherwife the action will belong to the order inflammation.

* This comprehends the order hemorrhagia of nofologifts. The fubdivifions are founded on the part affected. Apoplexy belongs to this order, being produced by a hemorrhagic action in the brain.

† This is entirely confined to the effects of thofe agents called medicines; fuch as, alum, galls, bark, bitters, &c. Thefe are often ufed to ftrengthen the body; becaufe they excite an action nearly fimilar to the natural one; and, if

Order 5. HECTICÆ.—Frequent pulſe, weakneſs, ſweats, and purging, heat of the ſkin, fluſhed face, thirſt, waſting of the body, without any ſpecific action *.

Order 6. MECHANICÆ.—General action, dependent chiefly on ſome local cauſe, acting mechanically †.

CLASS IV.

A. Diſſimiles.

ACTIONS very diſſimilar to the na-

given gradually, they do in the end in reality increaſe the healthy action, by having for ſo long induced one in an increaſed degree, which nearly reſembles it.

* The different ſpecies of phthiſis, attrophy, &c. are to be placed here.

† Of this kind is jaundice, proceeding from biliary obſtructions.

tural action, and which may be called specific *.

Order 1. INTERMITTENTES.—Actions which alternately disappear and return, or remit and increase, for a certain time †.

Order 2. TYPHOIDES.—Great prostration of strength; pulse frequent, sometimes full at first, but always small, after the disease has continued for a short time; pain in the head, with disturb-

* These are, of all actions, the most dangerous, on account of the great and rapid weakness which most of them induce. Some call the agents productive of these, sedatives; but the name is improper, for they are very far from soothing. Agentes dissimiles, is, from the poverty of language, the best I can fix on.

† Such as the different varieties of intermitting fevers.

ance of the mental faculties; urgent thirſt, with foul tongue *.

Order 3. VENENOSÆ.—Great weakneſs, often attended with eruptions, or other local affections, produced by the application of what are called poiſons †.

CLASS V.

A. Mixtæ.

ACTIONS which are of a mixed nature, reſembling in part the claſs Similes, but having alſo ſome peculiar or diſſimilar action united to this.

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* Comprehends typhus, plague, cynanche maligna, the diſeaſe produced by the application of putrid matter to the body, &c.

† The bite of many ſnakes, the effects of lead, laurel, &c.

Order 1. ERUPTURÆ.—Actions producing numerous inflammations of the ſurface, combined with a ſpecific action, often ending in ulceration *.

Order 2. IMMUNDÆ.—Actions conſiſting in ſpecific inflammation, not neceſſarily confined to the ſurface, and generally ending in ulceration †.

Order 3. GLANDULARES. — Specific actions, producing a change in the quality and appearance of ſome natural ſecretion, which is, at the ſame time, generally increaſed in quantity ‡.

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* Such as ſmall-pox, meaſles, ſcarlatina, cow-pox, &c.

† Such as ſyphilis, cancer, elephantiaſis, frambœſia, phagedena, &c.

‡ Gonorrhœa belongs to this order.

Order 4. ULCERANTES.—Actions consisting in simple ulceration of a part, without any specific condition being conjoined *.

Order 5. CONNATÆ.—Morbid actions which are received at conception †.

Order 6. NARCOTICÆ.—Actions producing frequency of pulse, stupor, or sleep, with a disturbance of the imagination, and an inflammatory or hemorrhagic action of the brain, if excited to a sufficient degree ‡.

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* This order comprehends ulcers, succeeding to simple inflammation, which may properly enough be placed under the class Mixtæ, as the granulating action is a natural one, and the purulent action an unnatural one.

† Such as scrophula.

‡ Such as the actions of opium, hyocyamus, belladona, &c.

Order 7. DIMINUTÆ.—The natural action chronically impaired, and ſome peculiar or ſpecific action conjoined *.

Order 8. ADAUCTÆ.—An increaſe of ſome function, or part of the natural action, conjoined with ſome ſpecific condition †.

Order 9. IRRITATÆ.—Increaſed and ſpecific actions of the ſyſtem, productive of local inflammation, if excited to a ſufficient degree ‡.

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* Such as ſcorbutus.

† Pertuſſis, diabetes, &c.

‡ This differs both from the order Inflammatæ and the order Stimulantes, by having a ſpecific action conjoined with the general or local increaſe. It comprehends the actions of mercury, arſenic, copper, nitrous acid, &c.

CLASS VI.

A. Mentales.

MORBID conditions, seated either entirely in the mind, or operating on the body, through the influence of the mind, or on the mind, through the influence of the body.

Order 1. IDIOPATHICÆ.—Conditions consisting entirely in some mental derangement, without any considerable alterations in any of the functions of the animal.

Order 2. CORPOREÆ.—Alterations in the functions of the body, in consequence of some morbid operation of the mind.

Order 3. Symptomaticæ.—An affection of the mind, dependent on ſome diſeaſe of the body.

Every new or morbid action has naturally a certain courſe which it is inclined to run, or a certain ſeries of ſymptoms or effects which muſt be produced, before it can be removed. When this courſe is accompliſhed, and the action has become complete, many of them diſappear, and the natural action returns in perfection. This is illuſtrated by the actions of wine, of common inflammation, of mercury, and of typhus fever. Others, as, for inſtance, intermitting fevers, having run one courſe, begin another, exhibiting a ſeries of alternations betwixt health and diſeaſe. In ſyphilis, again, and ſome other diſeaſes,

we find, that the action, when completed and made perfect, continues in that ſtate without diminiſhing or diſappearing.

By a knowledge of the facts already mentioned, we cure diſeaſes, or remove dangerous actions. Certain actions, we have ſeen, diſappear ſpontaneouſly, after having run their courſe: Theſe we may, therefore, either altogether neglect, or, if this be imprudent, on account of their violence, we may attempt to make them run their courſe more ſpeedily. When a part becomes inflamed, we find, that the ſymptoms continue increaſing for a time, and then leſſen, leaving the part either healthy, or in poſſeſſion of another action, called the purulent. In this diſeaſe, then, we have an augmentation, an acmé, and a decline. When we attempt to diminiſh this action, we make that pe-

riod, in which we begin our treatment, the acmé, and the ſubſequent one the decline. In this caſe, it is often, though not always, comparatively ſpeaking, of little conſequence, whether we endeavour, by art, to complete the action ſpeedily, or allow it to follow its courſe more extenſively and tediouſly. But, in the typhus fever, the danger is always increaſing, in proportion to the duration of the action; and, therefore, we ought, if poſſible, to complete it ſpeedily. This we endeavour to do, in the very beginning, by an emetic, which, inducing the hot and ſweating ſtages, often terminates the action.

There are other actions, however, which, we have ſeen, have no tendency to diſappear, after all the ſtages are gone through. Of this kind, amongſt many others, are intermittent fever and ſyphi-

lis. In theſe diſeaſes, then, we muſt unavoidably follow, in every inſtance, that courſe, which, in inflammation, we may or may not purſue, as circumſtances direct; namely, diminiſh the morbid action, by artificially reſtoring the natural one. In inflammation of ſtrong parts, we might, by induction, diſcover the method of reſtoring health; for, if the diſeaſe conſiſts in the natural action, increaſed to ſuch a morbid degree as to change its nature, it is plain, that whatever would, in health, diminiſh the natural action, muſt here be of ſervice. But, in the cure of the diſeaſed actions at preſent under conſideration, we can derive no ſuch aſſiſtance from reaſoning or judgment, becauſe we are not ſo well acquainted with the nature of theſe actions. We have, accordingly, been altogether indebted to empyriſm for a cure; but now, that the remedies are diſcover-

ed, we can aſcertain the principle on which we proceed. In theſe diſeaſes, it is impoſſible to reſtore directly the natural action; becauſe the morbid one will not yield to it. We are, therefore, obliged to deſtroy the diſeaſed action, by inducing another which is able to diſplace it, in the ſame way as it had removed the natural one. But this is not all which muſt be done; for we ſhould ſtill have only exchanged one diſeaſe for another, unleſs we had been careful to remove the firſt and obſtinate diſeaſed action, by another which would diſappear, after having run its courſe, and allow the natural one again to appear*.

* In the cure of diſeaſes, we ought not only to attempt removing the morbid action, by inducing ſuch another general condition as ſhall anſwer our intention; but alſo, to attend to the removal of particular ſymptoms of the action, which will much co-operate with our general plan. In thoſe actions, which we cannot yet cure by general re-

To apply this to ſyphilis;—it may be obſerved, that the mercurial action is as diſſimilar to the venereal action, as this laſt was to the natural one; and, therefore, will remove it in the ſame way, and exactly on the ſame principle, on which the venereal action had taken place of the natural one. This being done, the patient is cured of one diſeaſe, but ſtill labours under another, namely, the mercurial action. When this ſubſides, he is well. In the ſame way, bark, arſenic, &c. cure agues.

medies, we are confined entirely to this removal of ſymptoms; and a proper interference, in this reſpect, by the application of ſuch remedies as ſhall do ſo, without, at the ſame time, tending to increaſe the morbid action, conſidered as a whole, requires the greateſt diſcernment of the phyſician. In fevers, and many other diſeaſes, people are much weakened; but he who ſhould, from the beginning, attempt to obviate this by wine, would find the general action much increaſed by it, and his patient rendered worſe.

UNFORTUNATELY, we are not able practically to apply this doctrine to the cure of many diseases; but this inability results not from any fault of the doctrine itself, but from our own ignorance of the nature of various actions, which prevents our opposing one to another with success *. Antimony has, by some, been proposed for removing the typhus action, cicuta for removing the cancerous

* It is a great loss to medicine, that distinctions have carefully been made betwixt what are called diseases, and what are called remedies. Do not the agents called medicines, and those which produce what we call disease, act all on the same principle? Do not both classes produce diseases, or unnatural actions? Might we not sometimes derive benefit from the actions which we call diseases, and which, in this case, we should find to be useful remedies? This has, in part, been admitted by many, who have wrote on the good effects of fevers in removing other diseases. It would, however, be requisite, that we should never induce a more dangerous action, in order to destroy one less.

diſeaſe, whilſt the ſcrophula has been promiſed to be cured by the muriated barytes, and the ſmall-pox to be prevented by mercury. But melancholy experience teſtifies the inefficacy of all theſe propoſals, and the impoſſibility, as yet, of inducing an action capable of diſplacing theſe terrible diſeaſes.

To conclude theſe obſervations, I may remark, that, although we may remove one action, by inducing another, yet this cannot be done, until the firſt has gone through all the eſſential ſtages to become perfect. Thus, mercury will not cure the venereal action, until inflammation, which is eſſential to the perfection of that action, has taken place. The typhus action cannot be removed, without ſweating, or moiſture on the ſurface, or ſome other ſecretion. The natural action, being always at its acmé,

or always complete, can be removed at any time; and the ſame may be ſaid of the inflammatory.

Of the different Syſtems of Pathology.

FROM what has been ſaid, it may appear, that we are to aſcribe both the health and diſeaſe of an animal, to the operation of the living principle. Until within theſe few years, however, phyſicians have been too apt to imagine, that the diſeaſes of man were ſimilar to the changes induced on common matter, referring them entirely either to an augmentation or diminution of his fluids, or to a depravation of the humours.

THE different fluids of the body, were all divided, by the ancients, into the natural, the ſecondary, and the unnatural

humours. The *natural* humours, they ſaid, were four in number: Firſt, the phlegm, or pituita, which was prepared from cold and crude aliment, and in greateſt abundance in old age, or the winter ſeaſon, when the low degree of heat favoured its production. This pituita was formed in the brain, from whence it deſcended, to lubricate the joints, and dilute the blood: It nouriſhed and ſupported the brain, and the cold parts of the body *. Second, the choler, or yellow bile, which was prepared in the liver: It was of a very hot and fiery nature; and, therefore, nouriſhed the hot parts, at the ſame time that it corrected

* The different parts of the body were ſuppoſed to be either hot or cold, dry or humid. The brain was one of the cold parts, and was ſuppoſed, by Ariſtotle, to moderate the heat of the heart. Ariſtot. de Part. Anim. cap. vii. lib. 2.

the pituita, and purged the inteſtines. Third, the atra bilis, or melancholic humour: This was prepared in the ſpleen, which it nouriſhed, as well as the drier parts of the body; it likewiſe promoted appetite. Fourth, the blood, which was prepared in the liver, from whence it was ſent to all the different parts of the body, going out by day to the extremities, and returning by night to the more noble parts *.

THESE humours were ſuppoſed to operate more at one time than another, or to reign alternately; and, upon this conjecture, they explained, why certain diſ-

* "Mundus quatuor ex elementis conſiſtit, igne, aëre, "terra, et aqua: calido videlicet humido, frigido, et ſicco. "Iiſdem ex elementis quatuor totidemque humoribus et "homo conſiſtit; ſanguine ſcilicet, pituita, flava, et atra "bili. Et ſanguis quidem aëri, pituita aquæ, flava autem "bilis igni, atra vero terræ ſimulatur. Sanguis enim guſtu

eaſes were worſe at particular hours; the humour which produced them being then in its greateſt force. The blood reigned from three o'clock in the morning until nine; the choler, from nine in the morning until three o'clock in the afternoon; the black bile, from this hour until nine in the evening; and the pituita, from nine until the blood began again its reign.

The *ſecondary* humours were the invention of the Arabians, and were ſaid by them to be the different ſteps toward

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" dulcis eſt; pituita, ſalſa; flava bilis, amara; atra vero " aſcetoſa, et flaveſcens. Sanguinis autem locus, et ſpiritus " in corde eſt. A dextris quidem ejus ſanguis, a ſiniſtris " vero, ſpiritus conſiſtit. Flavæ bilis in jecinore; atræ in " liene; pituita quidem in cerebro, locus. Sanguis autem " calidus et humidus; pituita frigida et humida; flava bilis, " calida et ſicca; atra vero ſicca et frigida."

Hippocr. de Hom. Struct. ad Perdicam, &c.

nourishment: They were furnished by the blood, when it came to the part which was to be nourished.

The *unnatural* humours were those which were perverted and diseased; and then, whatever might have been their former quality, they became hot. The blood * and melancholy corrupted only in the veins; the other two humours corrupted out of the vessels.

These humours were supposed to possess different qualities, which they communicated to the body, and upon which depended the peculiar properties of the body, considered either as a whole or a part. These states were called condi-

* When the blood corrupted in its thicker part, it turned into melancholy; but when its thinner part was in fault, then it became choler.

tions, or temperaments, or conſtitutions; terms which are ſtill retained, and meant to expreſs the peculiar habit of body; as, ſtrong, weak, ſcrophulous, &c. *

The peripatetics, by the term temperament, or temperies, meant the condition of the body, with regard to the proportion of elements which it contained. The blood was ſaid to be hot and moiſt; melancholy, cold and dry; choler, hot and dry; phlegm, cold and moiſt. According, then, as theſe humours preponderated, the body was ſaid to poſſeſs a cold, hot, dry, or moiſt quality, condition, or temperament: And as theſe

* Inſtead of adhering to the old names, which depended upon the ancient theories of phyſic, practitioners have ſubſtituted a variety of new ones, correſponding to their own opinions; ſuch as, phlogiſtic, cahectic, ſthenic, aſthenic, irritable, &c.

ſtates were produced by the preſence of the humours, phyſicians at laſt came to name the temperament, from the humour which produced it, inſtead of the quality which it imparted. Thus, we had the ſanguineous, choleric (or bilious), melancholic (or atrabilian), and phlegmatic (or pituitous) temperaments, with many admixtures of each other, as, for inſtance, the ſanguineo-choleric, &c.

WHEN the doctrines of the ancients came to be more fully commented on, the temperaments were more minutely ſubdivided and explained. The temperies bona conſiſted, in a due proportion, of all the qualities capable of being poſſeſſed by a body; ſuch as, heat, cold, dryneſs, moiſture, denſity, rarity, hardneſs, ſoftneſs, viſcidity, volatility, &c. The temperies was called moderate, when the qualities were of a moderate degree; im-

moderate, when they went beyond moderation. It was called total, when it affected the whole body; and this, again, was divided into the sanguineous, melancholic, bilious, and pituitous, according as these humours predominated. It was called partial, when the condition of different parts was considered individually. Thus, the brain was cold and moist; the heart, hot and moist; the bone, dry and cold; and a regular gradation, or series of changes, was established betwixt these, consisting of parts which possessed these qualities in an intermediate degree; the cartilage, for instance, was not so dry or cold as the bone, &c. It was called native, when it was received at conception; communicated, or unnatural, when changed after birth: And the chief causes which induced these changes, were age, the season of the year, climate, and habits. It was called permanent, when

it depended on the formation of the part; temporary, when it depended on the fluids.

THE intemperies, or bad temperies *, was divided into the manifeſt and occult. The manifeſt was either ſimple, when only one quality was morbidly increaſed, producing the warm, dry, or cold intemperies, for example; or complex, when more than one was in fault, producing the dry and hot intemperies, &c. The occult was produced by ſome hidden vice; ſuch as, poiſon, contagion, &c.

BESIDES the natural humours, upon which the temperaments depended, and

* "Bona temperies eſt pars ſanitatis, quæ in qualitatum "conveniente conſtitutione conſiſtit."——"Intemperies "eſt morbus, qui in qualitatum coporis inconvenientia con-"ſiſtit." *Regii Lib. Med.* p. 5. et 24.

which were the cauſe of moſt diſeaſes, the ancients likewiſe admitted the exiſtence and operation of three different ſpirits, the natural, the vital, and the animal; and alſo the ſame number of faculties, called by the ſame name, which were the efficient cauſes of the different actions, in the performance of which the ſpirits were the inſtruments.

The natural ſpirit was ſuppoſed to be ſome fine exhalation from good blood, or ſome very delicate ſubſtance, prepared in the liver, from the blood and air *. This was the thickeſt and pooreſt of all the ſpirits, and was contained in the veins: It was the ſource of nutrition,

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* Every ſpirit was ſuppoſed to be formed from the blood, the thickeſt parts forming the loweſt kind of ſpirit. Theſe ſpirits were called the vehicles, through which the different faculties operated.

and conducted the blood and natural faculty to all the different parts of the body. Some phyſicians, from conſidering, that no air could reach the liver, or, if it did, that there were no cavities in it, to form the natural ſpirit, doubted of its exiſtence, and were confirmed in their ſcepticiſm, by obſerving, that there were no ducts leading from the liver capable of conveying it away; for they could not believe, that the thin coats of the veins could contain it. Theſe difficulties, however, were readily overcome; for, as Hippocrates had declared, that "omne corpus tranſpirabile eſt et tranſ-"fluxile," it followed, that the air might reach the liver, through the diaphragm; and as this ſpirit was thick, it followed, that the veins might contain it; and, being ſlowly produced, that no cavity was requiſite for its formation.

The vital ſpirit was prepared in the left ſide of the heart, from air and blood; and it was this union which produced the pulſe. Phyſicians readily explained, how the air, taken in by inſpiration, was prepared in the lungs, and conveyed, by the arteria venoſa, or pulmonary vein, to the left auricle of the heart: But they found it more difficult, to ſettle the controverſies which aroſe concerning the way in which the blood reached that cavity. According to Galen, the blood underwent ſome attenuation and preparatory change in the right ſide, whence part was ſent, by the pulmonary artery, to nouriſh the lungs; while the reſt was tranſmitted, through ſmall foramina in the ſeptum, to the left ſide. Columbus denied theſe pores to exiſt, and maintained, that the blood went from the one ſide to the other, by the circulation, which is now admitted and

eſtabliſhed as a fact. Botallus invented a particular duct for this purpoſe; whilſt Ulmus laughed at all theſe conjectures, and taught, that the blood underwent its preparatory change in the ſpleen, from which, by means of the aorta, it reached the left ſide of the heart. The blood and the air having, then, by ſome means or other, got together, they formed the vital ſpirit, which was contained in the arteries, where it could be felt bounding and jumbling, and by which it was conveyed to every part of the body, vivifying and preſerving thoſe parts which had been already formed by the natural ſpirit. "It maintains the heat, "(ſays Laurentius), brings out whatever "is lurking, and recruits the exhauſt-"ed. It ſhines by its own light, and "diſplays itſelf in every part of the "theatre of the human body; and, be-"ing diffuſed over it, every part rejoices,

"and appears with a roſy colour. When
"deſtroyed or intercepted, the whole
"ſhivers, becomes pale, and dies *."

The animal ſpirit was the fineſt of all, and could not be confined within the coarſer veſſels. It was ſuppoſed, for a long time, to be prepared in the anterior ventricles of the brain, from the vital ſpirit, which aſcended by the carotid and cervical arteries, and the air which was taken in by the noſtrils during reſpiration. That this was the caſe was conſidered to be proved; becauſe whether the carotid were tied, or the breath of the noſtrils ſtopped, the ſame effect, namely, apoplexy, was produced, the generation of this ſpirit being, in both inſtances, equally checked. When the circulation of the blood was diſcovered,

* Lamentii Opera, p. 569.

and the arteries were found to be full of arterial blood, then this doctrine of the ancients was new-modelled. The arterial blood, which was full of spirit, was sent, by the vessels, to the brain, where its watery part was separated, and passed off by the pituitary gland, whilst its spirit, or finer part, formed the animal spirit *.

Some denied the existence of this spirit, and thought that the vital spirit was sufficient for the operation of the body. Amongst these was Argenterius, who accused Galen of inaccuracy and contradiction; because, in one place, he attributes the generation of this spirit to the blood; in another, to the air; and in a third, to the vital spirit, which was said to form it, at one place, in the anterior

* De le boe Sylvius Opera Medica, p. 2.

ventricles; at another, in the plexus, or ſubſtance of the brain. But Laurentius* undertook to do away all theſe objections, and reconcile the apparent contradictions, by obſerving, that as the blood was neceſſary for the production of the vital ſpirit, and this ſpirit and air neceſſary for the generation of the ſpiritus animalis; therefore, all the three might properly be mentioned by Galen; and as for the objection, on account of the different places in which it was ſaid to be produced, this alſo was a quibble; becauſe it was prepared in the plexus and anterior ventricles, refined in

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* Laurent. Opera Omnia, p. 652.—This author was particularly angry at Argenterius, becauſe he had denied, that the fluid which came down the noſe, was the peculiar excrement of the brain, but was generated in the liver. "Me-"hercule, (ſays he), in doctrina Argenterii nullus eſt "infundibuli, et glandulæ pituitariæ in cerebro temperatiſ-"ſimo uſus." P. 664.

the third ventricle, perfected in the fourth, and diffused finally through all the substance of the brain and nerves.

This spirit, says Van Helmont, is the impetum faciens of Hippocrates, which holds the key of life in its hand. In the brain, it produced what are called the internal senses; when carried out of it by the nerves, it was the cause of motion, and the external senses. It has been already mentioned, that it was equivalent to the nervous energy of the modern schools.

Upon these humours and spirits, then, did the ancients found their system of physic *. Obstruction to the free motion of the animal spirit, produced pal-

* Disease, said they, is produced, by either a bad temperies, or by malformation of a part.

ſies, apoplexies, and convulſions; whilſt, when the vital ſpirit was affected, the heat of the parts, and their life, could no longer be ſupported, and mortification took place. A redundancy of blood produced phlegmon: The pituita cauſed dropſy; or, when the blood was full of it, from "multiplied crudities," then it fell upon the joints, and ſwelled them: The choler produced jaundice, dyſentery, and eryſipelas; whilſt the atra bilis, or melancholic humour, cauſed cancers; and, by "its fuliginous vapours aſcend-"ing to the brain," brought on many diſorders. Theſe diſeaſes were produced chiefly by an increaſed quantity of theſe humours; but, when they corrupted or changed, then no one pretended to eſtimate the evil which might follow. Nay, not ſatisfied with corrupting themſelves, theſe humours enticed foreign contagions to combine with them, the venereal vi-

rus lurking in the pituita, whilſt the meaſles lodged in the choler.

The practice which naturally followed from this theory, was to expel the morbid humour; but this they could not do, until by remedies, or the proceſs of nature, it was concocted, and prepared for evacuation.

Although theſe were the prevailing doctrines concerning the cauſe of diſeaſes, in the ancient ſchools, yet moſt phyſicians admitted the co-operation of an intelligent principle *. To this principle, Hippocrates gave the name of nature, which he conſiders as of an excellent, and almoſt divine quality. This principle,

* "Medicina id quod moleſtat tollit, id a quo homo æ-"grotat auferens, ſanum facit. Natura eadem ſua ſponte "novit." *Hip. de Dieta.*

we are informed, is heat*; by which term, however, we are not to underſtand him as meaning common fire, but a principle ſui generis; for the ancients uſed this term in a very extenſive ſenſe. Thus, Ariſtotle † tells us, that the ſoul of man is heat; but cautions us from believing, that he means exactly any thing which we have ever ſeen in another ſituation. By comparing ſome paſſages of Hippocra-

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* The original theory of animal heat, was, that a calor nativus, or innate heat, exiſted in the left ventricle of the heart, which went out by the veſſels, and ſupported the body.

† "There is a certain animal heat diffuſed through the "univerſe, ſo that all things are, in a manner, full of "mind; on which account, they may be quickly com- "pleted into animals, when they have received a portion "of this heat. This is not fire, nor any thing like it, "but a ſpirit which is in the ſemina, or elementary prin- "ciples of bodies." *Ariſtotle de Generat. Anim.* lib. iii. c. 11. et lib. ii. c. 3.

tes with each other, and with the writings of the philosophers who lived about that time, we shall find it to be most probable, that, by the operations and interference of nature, he meant the agency of the soul *; a doctrine which was more

* The left ventricle is larger than the right, and is, as it were, gnawed. "Nam insitus a natura ignis non est in "dextro."—"Mens enim hominis in sinistro ventriculo "insita est, et reliquæ animæ imperat." *De Corde.*

"Et videtur sane mihi id quod calidum vocamus, immor-"tale esse, et cuncta intelligere, et videre, et audire, et "scire omnia tum præsentia tum futura." *De Carnibus.*

"Ignis enim omnia per omnia movere potest."

De Dieta.

Some were unwilling to admit, that Hippocrates really supposed that the soul had its seat in the breast, and imagined, that he either said so in compliance with common language, or because the great instrument of the mind (heat) resided there: But by comparing his words with the ideas of Aristotle, concerning the nature of the soul, it will appear, that he really believed the heart to be the seat of the anima, although its mental operations, or faculties, were exercised in the brain; and also, that the anima consisted of a somewhat, which he denominated heat.

exprefsly repeated by Stahl, and adopted by Mead *, and many of the more modern phyficians.

Anaxagoras, more decidedly, faid, that nature was the mind, or foul, " mentem appellat." Galen faid, that nature was a warm fpirit, " Natura item eft fpiritus calidus." Zeno, more bold, declared it to be common fire.

* " Such is the compofition of our fabric, that when " any thing pernicious has got footing within the body, " the governing mind gives fuch an impulfe to thofe in- " ftruments of motion, the animal fpirits, as to raife thofe " commotions in the blood and humours, which may re- " lieve the whole frame from the danger in which it is in- " volved." *On the Small Pox.*

In peftilential fevers, " the mind hurries to the affiftance " of the labouring frame, fights againft the enemy," &c. *Med. Precept.*

" Quis non videt in acutis pulfum vibrare vehementius, " fanguinem fervere, turbari omnia? Hæc ipfa vero virtus " naturæ eft, quæ alienum et crudum fic potentius fubigit " et fuis nocendi viribus exuit, vel fi exuere penitus non " poteft, ne novas turbas moliatur, tanquam indignum ar- " vis fuis calorum variis viis inter critica, ut vocant, moli- " mina expellit." *Richteri Opufcula*, Tom. I. p. 313.

The notion of all the humours being diſeaſed, was at laſt, in a great meaſure, overlooked, or attended to only by the bye; and the ſtate of the blood began to be conſidered as almoſt the only immediate cauſe of diſeaſe. The pathology of Sydenham was founded entirely on the condition of the blood, and the operation of the vis medicatrix naturæ. When a contagion was introduced into the blood, then nature excited a fermentation, in order to concoct, and finally expel it. This ſhe did, ſometimes quickly, ſometimes more ſlowly, generally by the help of a fever, terminating by looſeneſs, or ſweating. But in this, as well as in every other theory which admits the aſſiſtance of nature, we find, that the cauſe of the diſeaſe is moſt ridiculouſly miſapplied; for they by no means prove, that the peccant matter taken into the blood, would of itſelf be fatal; but they moſt abun-

dantly allow, that the interference of nature, which excites a dangerous diſeaſe, is often mortal, and, not unfrequently, the cauſe of the moſt laſting calamities. "What is gout, (ſays Sydenham), but a "contrivance of nature to purify the "blood of old men, and to purge the "deep parts of the body." Few people would thank Dame Nature for this friendly purgation.

The idea of concoction, and aſſimilation, was likewiſe adopted by Boerrhave, and is taught ſtill by ſome modern authors. But this great phyſician called in the additional aid of other principles, namely, the viſcidity and lentor of the blood, and the error loci of its globules. This doctrine, which will be more particularly illuſtrated in the theory of inflammation, had, in its principle, occured to Aſclepiades, who made diſeaſe con-

ſiſt in a want of proportion betwixt his atoms and the pores through which they were to paſs. Theſe doctrines of the origin and cauſe of diſeaſe, produced the moſt unhappy practice. Veneſection, emetics, purges, and ſudorifics, were rapidly preſcribed, one after another, to avert the danger, and the urine carefully examined, to mark the progreſs of the concoction; whilſt ſuch remedies as tended more effectually, and directly, to check the diſeaſe, were proſcribed and forbid, becauſe they produced no ſenſible evacuation.

The whole of theſe conjectures were evidently founded upon ignorant and miſtaken views of the animal economy. Unacquainted with the true laws of the living ſyſtem, they reaſoned upon the ſuppoſition of the blood being ſubject to the ſame changes, when circulating in

the veſſels of a man, as when collected and preſerved in their phials and matraſſes. They knew not the true hiſtory of our functions, nor the real cauſe of all the varied phenomena of life. Their heads were full of nothing but ſpirits, and humours, and ferments; and their ſyſtems were built entirely on plethora, and inanition, and cacochymy.

WHEN, at laſt, they began to ſee more clearly the agency of the nervous ſyſtem, and to abandon their belief in the co-operation of different ſpirits to produce the actions of life, they found it neceſſary to allow, that diſeaſes have their chief ſeat in the nervous ſyſtem; but being ſtill unwilling to give up their favourite doctrine of morbid humours, they aſſerted, that theſe ſtill exiſted, but operated through the medium of the nervous energy. Hoffman maintained the ſeat

of diſeaſes to be in "the living ſolid;" but avowed the agency of diſeaſed blood. Cullen, who improved this theory, acknowledged, in many inſtances, the derangement of the fluids: Nor is there almoſt any ſyſtem, even in the preſent day, in which it is not more or leſs allowed.

That medicines may, in ſeveral inſtances, be abſorbed, and mixed with the blood, will be allowed by all; but that they thus exert the whole of their influence, cannot be admitted; nor will it, by any means, be conſidered as true, that either medicines, or contagions, act by changing the nature, or altering the properties of this fluid, until it be proved, that the blood is not circulating in veſſels poſſeſſed of a power of acting on it, and until it be eſtabliſhed, that the blood is completely an extraneous ſubſtance, ſubject to all the laws of foreign matter, and

making no part of the living ſyſtem. That in diſeaſe the blood does change, to a certain degree, is aſcertained; but theſe changes are not the conſequence of any direct action upon it, by contagions, or medicines; they are analogous to the alterations which take place in the reſt of the ſyſtem, and depend upon the ſame cauſe, namely, a general affection of the living principle. One of the moſt evident changes induced upon the blood, and one which might be ſuppoſed to favour the doctrine of chemical changes, being induced directly by contagion, is its converſion from veinous into arterial, and from arterial into veinous; but even theſe changes, are very far indeed from being proved to depend upon chemiſtry, independently of the living principle. It is conſidered as proved, that the veinous blood is rendered arterial, by the oxygen of the atmoſphere being combined

with certain principles of the blood, and carrying theſe off, and that it is again rendered veinous, by the addition of theſe ſubſtances; but it is far indeed from being proved, that theſe combinations, and additions, take place independently of the action of the veſſels; nor is it even aſcertained, that the uſe of reſpiration is to purify the blood from theſe ſubſtances. Had this been all which was requiſite, they could have been removed by ſome particular excretion, as we ſee, in part, exemplified in the formation of the bile. The production and extrication of theſe ſubſtances, are, however, very much connected with the proceſs of reſpiration; for, we find, that whenever the arterial blood is converted into veinous, which tranſition takes place ſuddenly, certain ſubſtances are found in it; and theſe again are evolved, during the inſtant of its being changed into arterial. I formerly mentioned my

ſuppoſition of the production of vitality being the main intention of the function of reſpiration. This principle ſeems to be yielded to the nerves, by the minute arteries; and, at the ſame inſtant, the blood becomes black and veinous. There is then this connection betwixt the purification of the blood from carbone and hydrogene *, and the arterialization of it, or the furniſhing of the vital principle, that both take place at the ſame time, and that the one proceſs is, perhaps, inſtrumental in producing the other †.

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* Some deny that hydrogene is found in the blood; but other experiments prove, that it does make a part of veinous blood.

† In the fœtus, theſe changes on the blood take place without the aſſiſtance of the air, by the peculiar operation of the placenta, in which the blood is both freed from its carbone and hydrogene, and likewiſe acquires vitality, and the materials of nouriſhment. Some ſuppoſe, that this depends upon the fœtal blood coming in contact with the maternal in the placenta; but this is by no means proved.

The blood is to be confidered as a living fubftance, poffeffed of peculiar properties, and endowed with the power of preferving its fpecific nature, in common with other bodies. It is only whilft it remains in this living ftate, that it is ufeful to the fyftem; for, if its nature be changed, it is no longer that fluid which is requifite for life. It cannot even be rendered all veinous, which is the moft natural and eafy change which it can undergo, without immediate death being the confequence to the animal. How unphilofophical, how abfurd, then, muft it be, to talk of fermentations, affimulations, and putrefactions of the blood; and how thoroughly ignorant of the animal economy muft they be, who can ufe fuch language, or have recourfe to thofe miferable explanations of the caufe of difeafe!

From the whole of thefe confidera-

tions, we may reaſonably conclude, that we are to look for the origin and ſeat of diſeaſe, not in the ideal habitation of humours and ſpirits, not in the chemical changes or fermentations of the blood, but in the nervous ſyſtem.

Some of thoſe who attended moſt to this ſyſtem, attributed much to ſpaſmodic actions; ſome admitted peculiar and varied actions of the nervous ſyſtem; whilſt others referred diſeaſe entirely to the different degrees of excitement, as they called it, of the living principle.

The firſt of theſe ſuppoſitions was very ably ſupported by Dr. Cullen, who believed, that, in many inſtances, the vis medicatrix naturæ, in order to get quit of ſome noxious power, formed a ſpaſm on the extreme veſſels, the conſequence of which was, an increaſed action of the

heart and arteries, in order to overcome this, and cure the disease *. How far this theory explains the different circumstances attending inflammation, and, consequently, how far it is founded upon facts, and good reasoning, will afterwards come to be considered; and, therefore, to prevent repetition, I shall only observe, in this place, that the Cullenian doctrine is subject to this objection, in common with others, which admit the operation of an intelligent principle in the cure of diseases; that the whole series of dangerous symptoms, or, in other words, the disease itself, is produced, not directly by the application of hurtful agents, but by the supposed interference of the healing power of nature, quod erat absurdum.

MR. HUNTER has given us no regular

* First Lines, &c. Vol. I. chap. ii.

ſyſtem of pathology; but, by gleaning his works, we learn, that he conſiders, firſt, that every operation of the body is an action of the living principle *; ſecond, that no two actions can take place at the ſame time, and in the ſame part, more than two different motions in a piece of matter †; third, that a diſeaſe is propagated from a part to the whole, by means of the ſympathy which exiſts through the whole body, by the diffuſed principle of life. This principle "is, as "it were, diffuſed through the whole "ſolids and fluids, making a neceſſary "conſtituent part of them, and forming "with them a perfect whole, giving to "both the power of preſervation, the "ſuſceptibility of impreſſion, and, from

* Hunter on the Blood, &c. p. 5.

† Ditto.

" their conſtruction, giving them conſe-
" quent reciprocal actions. This is the
" matter which principally compoſes the
" brain *."

Upon the two firſt propoſitions I ſhall make no remark, becauſe I have already endeavoured to eſtabliſh and illuſtrate them. They are, in my opinion, the moſt rational foundation upon which a ſyſtem of phyſic can be reared, and are ſo ſelf-evident, that they occurred to me ſoon after I began to ſtudy medicine, and before I had any opportunity of knowing that they were propoſed by Mr. Hunter. Upon the third propoſition, I have only to repeat the remark which I formerly made, that it teaches a very confined idea of life, which, according to this ſuppoſition, can only be united

* Hunter on the Blood, &c. p. 89.

with a certain ſtructure, the exiſtence of which, in many caſes, is far from being proved.

Dr. Brown attempted to ſimplify medicine, and reduce every diſeaſe to one of two cauſes *. He began by obſerving, that " a certain quantity of excitability " (or living principle) is allotted to every " one at birth †."—" That this is acted " upon by different powers, which are " termed exciting powers; and their ef- " fect on the excitability is called ex- " citement ‡."—" This mutual relation " obtains betwixt excitability and excite-

* This doctrine had, in its principle, occurred to Themiſon, the founder of the Methodic ſect, who maintained, that diſeaſes depended npon either an overbracing or a relaxation of the ſyſtem.

† Elements of Medicine, Par. xviii. p. 7.

‡ Par. xvi. p. 5.

" ment, that the more weakly the pow-
" ers have acted, or the leſs the ſtimulus
" has been, the more abundant the ex-
" citability becomes; the more powerful
" the ſtimulus, the excitability becomes
" the more exhauſted *."—" In both
" of theſe circumſtances, weakneſs takes
" place, which, in the firſt caſe, is called
" direct, in the ſecond, indirect †."—" It
" is the excitement alone, through its va-
" rying degrees, that produces either
" health, diſeaſe, or recovery ‡."—" The
" general diſeaſes, ariſing from exceſſive
" excitement, are called ſthenic; thoſe
" that originate from a deficient excite-
" ment, aſthenic. Hence there are two
" forms of diſeaſes, and both are always
" preceded by prediſpoſition §."—" That

* Par. xxiv. p. 15.

† Par. xxxv. and xlv.

‡ Par. lxii. p. 50.

§ Par. lxvi.

" this is the only real origin of diſeaſes
" and prediſpoſition *, is proved, by the
" ſame powers which produce any diſ-
" eaſe or prediſpoſition, alſo producing
" the whole ſet of diſeaſes to which it
" belongs; and by the ſame remedies
" which cure any diſeaſe or prediſpoſi-
" tion, alſo curing all the diſeaſes and
" prediſpoſitions of its reſpective form †."
The operation of all contagions is ſtimulant, and " no remedies, but thoſe that
" cure diſeaſes produced by the uſual
" noxious powers, remove thoſe ſuppoſ-
" ed to be induced by contagion ‡."—
" Though the fluids may be corrupted,

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* " Prediſpoſition is a ſtate intermediate betwixt perfect " health and diſeaſe: The powers producing it are the " ſame with thoſe which produce diſeaſe." Par. lxxiii. p. 59.

† Par. lxvii. p. 51.

‡ Par. xxi. p. 10.

" yet this is not a cauſe, but an effect of " weakneſs. Wine, bark, &c. by ſtrength- " ening the veſſels, purify their con- " tents *." In the indication of cure, the only regard to be had to morbific matter, is to allow time for its paſſing out of the body; and that, whether it ſtimulates or debilitates, or gives the peculiar form to the diſeaſe, thereby adding a local to a general complaint; for, if the general diſeaſe be properly healed, the eruptions, inflammation, ulcers, will give way to the happy effects of the general cure †.

To conclude, " the whole and ſole " province of a phyſician, is not to look " for morbid ſtates and remedies, which

* Par. cxviii.

† Par. xcvii. p. 81.

"have no exiſtence, but to conſider the "deviation of excitement, from the "healthy ſtandard, in order to remove "it by the proper means *."—"Such is "the ſimplicity to which medicine is "thus reduced, that when a phyſician "comes to the bed-ſide of a patient, he "has only three things to ſettle in his "mind; firſt, whether the diſeaſe be "general or local; ſecondly, whether it "be ſthenic or aſthenic; third, what is "its degree †."

Upon this ſyſtem I would have expected, that very little obſervation would have been neceſſary to ſhow its abſurdity; and I ſhould have done no more than merely ſtate it, were we not every

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* Par. cxlix. p. 138.

† Par. lxxix. p. 64.

day told of the progrefs which it is making. One great and leading error, which every one will obferve, is, that he fuppofes the more life or excitability that any perfon has, the nearer he is to death *. Here the dependence of energy for its production, upon the continuance of natural action, is overlooked. When the action is too little, energy is not produced; when the action is too great, or in a morbid degree, its production is not only injured, but more is expended than can be generated. Thefe are the effects produced by a deficiency or increafe of action, to a morbid degree. There can be no accumulation of life, or, were it to take place, as from want of food, for inftance, then it follows, that any ftimulus given before death, fhould preferve life; and the living power being very

* Par. xxiv.

abundant, the perſon ought eaſily to bear a ſtrong ſtimulus, which is far from being the caſe.

This, however, is a very trifling miſtake, when compared to the next error, which teaches, that all diſeaſes conſiſt entirely in different degrees of excitement of this life, and not in any new and peculiar operation or action which it performs. Do not all the phenomena of fevers, ſmall-pox, ſyphilis, and almoſt every diſeaſe, controvert this doctrine in the ſtrongeſt manner? Will every ſtimulant cure the venereal inflammation? Will wine cut ſhort the progreſs of a fever? Is it debility alone that is to be regarded in the treatment of a fever, and ſtimulants alone that are to be adminiſtered *? I will venture to affirm,

* Par. dclxxx.

that if this practice be followed out, no man can eſtimate the lives which ſhall be loſt. If debility alone produces fevers, I will demand of the Brownonian, Why, in the courſe of a few hours, the pulſe falls from its great frequency almoſt to the natural ſtandard, and that without any ſtimulant being exhibited, or the patient feeling, in the leaſt degree, ſtronger, or being able to make one greater exertion? I ſhudder when I recollect the ſcenes which I have witneſſed, and the miſerable effects of the blind Brownonian practice. Wine and opium, I do moſt ſincerely believe, are, in the hands of Brown's diſciples, what fire and ſword are in the battles of the cruel.

From the apparent ſimplicity of this theory, the ſtudent is led to neglect the various operations of the ſyſtem, and diſregard the nicer ſymptoms and diſtinc-

tions in diseases, being taught, that his sole province is to inquire into the degree of excitement, that he may bleed in one case, and give wine in another. And, to remove any scruples which may still remain in his mind, concerning the radical differences of diseases, he is assured, in the strongest manner, that in no respect are they different, except in the circumstances of strength or weakness; that there are no specific operations of the living system, no alterations even in the fluids, (which were to the humouralist what the nervous system ought to be to the true physiologist), modifying the disease; and that, therefore, he need not, on this account, think of varying his treatment; for all eruptions and conditions, thus induced, will yield to the sthenic or asthenic plan.

From this leading error in the system,

it is aſtoniſhing how little able many Brownonians are to diſtinguiſh betwixt two diſſimilar diſeaſes, which have ſome general ſymptoms in common. This, it may be ſaid, ought to be placed to the account of the ſtupidity of the phyſician; but, certainly, the doctrines which this ſyſtem teach, are well calculated to increaſe that natural ſtupidity, by giving little incentive to inveſtigation.

Of late, this theory has been modified, by the introduction of chemical principles, many diſeaſes being attributed to an increaſe, or deficiency, of oxygen, as well as a deviation from the due ſtate of excitement. Whether oxygen be, or be not preſent, in greater and leſs quantities, at different times, is a point which I ſhall not inquire into; but I think it is pretty evident, that if, in any diſeaſe, there be too much, or too little, of any chemical

principle present, or employed in the whole syftem, or a part of it, the mere addition or subtraction of part of that principle will not inevitably cure the difeafe, becaufe we do not thus alter the action which conftitutes the difeafe; and this redundancy, or deficiency, is a fymptom, and not a caufe. We never can prevent the introduction of what may be called the chemical elements into the body by any means whatever. They are all effential to our exiftence, and the modification which they receive will continue as long as the action exifts which regulates or produces it, whatever chemical or mechanical contrivances we may fall upon to prevent it. If phthifis depended upon the prefence of too much oxygen in the blood, which is not proved, we could not cure it by breathing an impure air, becaufe the oxygen which the atmofphere did contain would be more

completely confumed; and if we gave lefs than the quantity neceffary, refpiration would ceafe to be properly performed, juft as it would in health be injured by a proportionate diminution. It is likewife a very miftaken notion, that becaufe hydrocarbonate, and other airs, mixed with that which we breathe, give relief fometimes, therefore a diminifhed quantity of oxygen is ufeful. They forget that thefe airs are very powerful medicines, and act independently of their mechanically leffening the quantity of oxygen, by occupying its place. The proper argument would be, to prove, that the poor, in their low, ill aired habitations, live longer in confumption than the rich, which few will believe. It is likewife conjectured, that, by adding the chemical principle in fuperabundance, we induce the difeafe or condition, which is fuppofed to depend upon the prefence of

this; as, for inſtance, it is ſuppoſed that too much oxygen will produce phthiſis; if ſo, the pureſt air ought to be moſt unhealthy, and thoſe who live in the country, and on mountains, ought to be moſt ſubject to conſumption. So ſanguine is one gentleman in his belief of this doctrine, that he hopes, chemically, to ſuſpend the laws of nature, and make the trees diſtil butter and cream. This would be a valuable diſcovery for the Hindoos; for, by a ſimilar proceſs, they might procure beef and mutton, without taking exiſtence from an animated being. I know only one ſtory which can match this, and indeed the whole theory, and that is, the old tale of a town, where roaſted pigs run through the ſtreets with knives and forks ſtuck in their poſteriors, crying, Come eat us! Come eat us!

The laſt theory which I ſhall take no-

tice of, is that of the very ingenious Dr. Darwin; which, in one respect, is similar to the Brownonian doctrines, but differs in the particular steps, leading to the general principles.

To examine this theory fully, would, on account of its complexity, require more time than is compatible with my present purpose. I can, therefore, only give here the outlines, and most fundamental parts of the doctrine.

" The whole of nature * (according to " Dr. Darwin) may be supposed to con- " sist of two essences, or substances, one " of which may be termed spirit, and the " other matter. The former of these " possesses the power to commence, or " produce motion, and the latter to re-

* Zoonomia, Vol. I. p. 5.

" ceive and communicate it. So that
" motion, confidered as a caufe, immedi-
" ately precedes every effect; and, confi-
" dered as an effect, it immediately fuc-
" ceeds every caufe."—" The motion of
" matter may be divided into two kinds,
" primary and fecondary. The fecon-
" dary motions, are thofe which are
" given to, or received from other mat-
" ter in motion."—" The primary mo-
" tions of matter may be divided into
" three claffes; thofe belonging to gra-
" vitation, to chemiftry, and to life; and
" each clafs has its peculiar laws."—
" This laft clafs of motion is the fubject
" of the following pages." Motion, which
is defined " to be a variation of figure *,"
is divided, in the animal body, into two
claffes:

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* Zoonomia, Vol. I. p. 15.

First, Senſorial motions, or thoſe peculiar to the ſenſorium, which conſtitute the ſenſation of pleaſure and pain, and which conſtitute volition, and cauſe the fibrous contractions, in conſequence of irritation, or aſſociation. Theſe motions are not fluctuations of the ſpirit of animation, nor vibrations, nor equilibrations, but changes, or motions of it, peculiar to life *. They are the faculties, or motions of the ſenſorium, to be afterwards mentioned.

Second, Fibrous motions, which include the motions of the muſcles, and organs of ſenſe †, which are contractile, and which, by their various configurations, give us ideas.

* Zoonomia, Vol. I. p. 33.

† Ditto.

THE ſpirit of animation is the immediate cauſe of the contraction of animal fibres. It reſides in the brain and nerves, and is liable to general and partial diminution, or accumulation. It is alſo called the ſenſorial power *.

THE ſtimulus of external bodies is the remote cauſe of this contraction.

A CERTAIN quantity of ſtimulus produces irritation, which is an exertion of the ſpirit of animation, exciting the fibres into contraction.

A CERTAIN quantity of contraction of animal fibres, if it be perceived at all, produces pleaſure; a greater, or leſs quantity of contraction, if it be perceived at

* Zoonomia, Vol. I. p. 30.

all, produces pain. Theſe conſtitute ſenſation.

A certain quantity of ſenſation produces deſire, or averſion. Theſe conſtitute volition.

All animal motions, which have occurred at the ſame time, or in immediate ſucceſſion, become ſo connected, that, when one of them is reproduced, the other has a tendency to accompany or ſucceed it. When fibrous contractions ſucceed or accompany other fibrous contractions, the connection is termed aſſociation: When fibrous contraction ſucceeds ſenſorial motions, the connection is termed cauſation: When fibrous and ſenſorial motions reciprocally introduce each other, it is termed catenation of animal motion. All theſe connections are ſaid

to be produced by habit, that is, by frequent repetition *.

The spirit of animation acts in four different ways, or "possesses four different faculties †;" and the contraction of all the fibrous parts of the body depends upon the exertion of these powers. The property, or capability, of causing fibrous contractions, in consequence of the irritation of external bodies, is called irritability, and the effect irritation; which is defined to be an exertion, or change of some extreme part of the sensorium, residing in the muscles or organs of sense, in consequence of the appulses of external bodies.

The faculty of causing fibrous contractions, in consequence of the sensations of pleasure and pain, is termed sensibility.

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* Zoonomia, Vol. I. p. 31. † P. 32.

and the effect senſation; which is an exertion, or change of the central parts of the senſorium, or of the whole of it, beginning at ſome of thoſe extreme parts of it which reſide in the muſcles or organs of ſenſe.

The power of cauſing fibrous contractions, in conſequence of volition, is called voluntarity, and its effect volition; which is an exertion, or change of the central parts of the ſenſorium, or of the whole of it, terminating in ſome of theſe extreme parts of it, which reſide in the muſcles or organs of ſenſe.

The capability of cauſing fibrous contractions, in conſequence of the aſſociation of fibrous contractions with other fibrous contractions, is termed aſſociability, and the effect aſſociation; which is an exertion, or change of ſome extreme

part of the ſenſorium, reſiding in the muſcles or organs of ſenſe, in conſequence of ſome antecedent, or attendant fibrous contraction.

As theſe faculties, at the time of their exertion, may be termed motions (for we cannot paſs from a ſtate of inſenſibility or inaction to a ſtate of ſenſibility or exertion, without ſome change in the ſenſorium, and every change includes motion), they may be called ſenſorial motions.

The fibrous motions of the animal, then, are of four different kinds, irritative, ſenſitive, voluntary, and aſſociate.

In every contraction of a fibre, there is an expenditure of the ſenſorial power, or ſpirit of animation; and, when the exertion of this ſenſorial power has been

for ſome time increaſed, and the muſcles, or organs of ſenſe, have, in conſequence, acted with greater energy, there is an exhauſtion of the quantity of power: On the contrary, when there has been leſs exertion, it becomes accumulated in the inactive part *.

Strength is the conſequence of the preſence of a great quantity of ſtimulus and ſenſorial power; for the quantity of motion produced in any particular part of the animal ſyſtem, will be as the quantity of ſtimulus, and the quantity of ſenſorial power, reſiding in contracting fibres.

If the quantity of ſenſorial power remain the ſame, but the quantity of ſtimulus be leſſened, then *debility from defect of ſtimulus*, or direct debility of Dr.

* Zoonomia, Vol. I. p. 72.

Brown, is produced; in which caſe the contractions are feebler, and often retrograde.

If the quantity of ſtimulus remain the ſame, but the quantity of ſenſorial power be leſſened, then *debility from defect of ſenſorial power*, is produced, or indirect debility *.

Disease is the conſequence of any deviation of theſe motions from the healthy ſtate; and, therefore, are divided into diſeaſes of irritation, ſenſation, volition, and aſſociation †; for an account of which, as well as of the minuter parts and illuſtrations of the theory, I muſt refer to the work itſelf.

In examining the truth of this theory,

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* Zoonomia, Vol. I. p. 75. † P. 361. et ſeq.

it is proper, firſt, to conſider, how far the doctrine of ſimple motions will explain the phenomena of life; and, ſecond, how far their derangement will account for the different diſeaſes. It would be endleſs to follow the application of this theory through the whole animal economy. I ſhall deem it ſufficient to attend only to one or two functions, particularly digeſtion and ſecretion.

The whole ſyſtem, ſays Dr. Darwin, conſiſts of extremities of nerves; and all the filaments either do poſſeſs, or once poſſeſſed, the power of contraction *. By the motion of theſe fibres, are all the operations of the living ſyſtem, and all its functions, immediately performed. Now, theſe motions can only conſiſt either in contraction or dilatation,

* Zoonomia, Vol. I. p. 463.

in various directions. This, I apprehend, must be admitted; and no other kind of motion is proposed by Dr. Darwin, except sensorial motions, which give pleasure and pain. The operation of sensation, or the sensorial motions, is indeed very fully admitted in this theory, and supposed to regulate many of the functions *; but still these must, in the end,

* "If the food which we swallow is not attended with "an agreeable sensation, it digests less perfectly; and, if "a very disagreeable sensation accompanies it, such as a "nauseous idea, or very disgustful taste, the digestion be-"comes impeded, or retrograde motions, of the stomach "and œsophagus, succeed, and the food is ejected." Zoonomia, Vol. I. p. 390.—"Every kind of gland must "possess a peculiar kind of irritability, and, probably, "sensibility, at the early state of its existence, and must "be furnished with a nerve of sense, or of motion, to per-"ceive, and to select, and to combine, the particles which "compose the fluid it secretes." P. 516.—"It would "seem, that all the glands in the body have their secreted "fluids affected, in quantity and quality, by the pleasur-"able or painful sensations, which produce or accompany

operate upon the fibrous contraction, which I can conceive only to admit of two states, namely, relaxation and contraction. Now, these never can explain the varied phenomena of life, and all its intricate and peculiar actions; neither can it possibly account for the diseases to which we are subject, even although we admit of all the complications of motion which Dr. Darwin supposes to exist.

If I have succeeded in establishing the doctrine of varied and constant actions, in the living system, then Dr. Darwin's theory, of the effects of simple motions, is necessarily unfounded; and if the ef-

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"those secretions; and that the pleasurable sensations, "arising from these secretions, may constitute the unnam-"ed pleasure of existence, which is contrary to what is "meant by tedium vitæ, or ennui." P. 518.

fects of actions upon the body, depends not altogether upon their quantity or degree, but alſo upon their ſpecies, or ſimilarity or diſſimilarity to the natural action, then the ſuppoſition made by Dr. Darwin and Dr. Brown, that the expenditure of power or weakneſs, is proportioned exactly to the quantity of exertion, motion, or excitement, is unfounded; and if the doctrine, of the production of energy being dependent upon the due preſence of action, be admitted, the ſuppoſition of the accumulation of excitability, or ſpirit of animation, muſt likewiſe be unſupported.

Before quitting this ſubject, I ſhall, for the ſatisfaction of the reader, take notice of the explanation which is given of fever *.

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* Zoonomia, Vol. I. p. 380. et ſeq.

When, by the application of cold, inanition, fear, &c. a torpor, or quiefcence, of any confiderable part of the circle of irritative motions, is induced, the whole clafs of them is more or lefs difturbed, by their irritative affociations; or, in other words, if any fuch debilitating caufe be applied to a part, the reft quickly fympathifes, and becomes weakened. From the quiefcence of the particular organs concerned in producing the various functions, we have diminution of thefe functions, ficknefs, vomiting, palenefs, coldnefs, weak and fmall pulfe, &c.

But, "as foon as this general quief-
"cence ceafes, either by a diminution of
"its caufe, or by the accumulation of
"fenforial power, which is the natural
"confequence of previous quiefcence,
"the hot fit commences." Every gland

is now ſtimulated into ſtronger action than is natural; there is a ſuperabundance of all the ſecretions, and, in conſequence of this, an increaſe of heat; the ſkin becomes red, and the perſpiration great; but, as the abſorption is ſtill great, the ſweat is not perceived, until, in the decline of the hot fit, the mouths of the abſorbents of the ſkin are expoſed to the cooler air, or bed-clothes, by which they loſe their increaſed activity, and ceaſe to abſorb more than is natural; but the ſecerning veſſels act for ſome time longer, being kept warm by the circulating blood; and, therefore, we have a ſweating ſtage.

When the contractile ſides of the heart and arteries perform a greater number of pulſations, in a given time, and move through a greater area at each pulſation, whether theſe motions be produced by

the acrimony or quantity of the blood, or by aſſociation with other irritative motions, or increaſed ſenſorial power, or by any ſtimulus, we have ſynocha, or irritative fever, with ſtrong pulſe*. When, again, the contractile ſides of the heart and arteries perform a greater number of pulſations, in a given time, but move through a leſs area at each pulſation, from defect of ſtimulus, or of ſenſorial power, we have typhus mitior, (or nervous fever), or irritative fever, with weak pulſe †. Beſides theſe febrile motions, induced by irritation, it frequently happens, that pain is excited by the violence of the fibrous contractions, and other new motions are ſuperadded, in conſequence of ſenſation. This, which occa-

* Zoonomia, Vol. I. p. 361.

† P. 362.

ſions inflammation, gives a different form to the fever, which is called ſenſitive *, and, like the irritative fever, will naturally be of two kinds, having the ſtrong and weak pulſe ; the firſt is called inflammatory fever, the ſecond, typhus gravior. This is farther explained, by obſerving, that, when the motions of any part of the ſyſtem, in conſequence of previous torpor, are performed with more energy than in the irritative fever, (or than is compatible with the exiſtence of ſimple irritative fever), a diſagreeable ſenſation is produced, and new actions, of ſome part of the ſyſtem, commence, in conſequence of this ſenſation, conjointly with the irritation ; which motions conſtitute inflammation ; and, according as this has taken place, in one or other of the ſpecies of irritative fever, ſo ſhall we

* Zoonomia, Vol. I. p. 391.

have either inflammatory or putrid fever *.

Upon this subject, I shall only remark, that the general account of the production of the symptoms of fever, is not satisfactory, and that the causes assigned will not produce the effect, as will, I presume, sufficiently appear, from what has been already said in this dissertation. Cold, applied to the system, may sometimes produce fever; but, upon this supposition, it ought uniformly to do so, which is not the case; and farther, every debilitating cause, as venesection, poor diet, want of food, &c. ought always to be followed by paroxysms of fever, in consequence of the quiescence which they induce. There is, likewise, no proof, that sensation affects

* Zoonomia, Vol. I. p. 412.

the nature of a fever, and produces local inflammation; but there is very abundant evidence, that peculiar agents, acting on the living ſyſtem, may induce fever, and modify the action, to an almoſt endleſs degree, producing the whole tribe of febrile diſeaſes.

Summary of the Laws of Action.

Having made theſe obſervations upon the different ſyſtems of pathology, and having, in the courſe of this diſſertation, endeavoured to eſtabliſh the neceſſity of attending to the actions of the living ſyſtem, and of aſcribing to them the phenomena of health and diſeaſe, inſtead of indulging in ſpeculations concerning the fluids, or their changes, or about ſimple excitement, or motions of the ſyſtem, I ſhall now conclude this

part of my ſubject, with a ſhort ſummary and illuſtration of the doctrine. For which purpoſe, I obſerve,

First, That the nervous energy, unacted on, can exhibit no phenomena, nor perform any operations.

Second, Arterial blood ſeems to be the natural and indiſpenſible ſtimulus to this nervous ſyſtem, or agent, enabling the energy to perform its operations. It is likewiſe the ſource of renewal to this energy.

Third, In a ſtate of health, there is a particular action preſent in the ſyſtem, upon which that ſtate depends. This may, therefore, be called the natural action, and conſiſts, collectively, of all the operations or phenomena neceſſary for the exiſtence of the animal.

Fourth, This action is an operation of the nervous energy, which is, therefore, employed and expended in its performance; on which account, there must be a regular renewal of power; and this renewal is dependent upon the proper action of the nerves *.

Fifth, All external agents, or foreign bodies, capable of operating on the body, must induce an action, more or less different from the natural one; or, in other words, will change the action of the sy-

* In some diseases, we find, that the nerves do not take from the blood as much life as it is capable of yielding. In this case, the blood in the veins is redder than usual, and, when drawn, coagulates, almost totally, into a mass, containing, like the coagulum of arterial blood, the greatest quantity of the serum, blended with the other principles. In many diseases, proceeding from derangement of the stomach and bowels, and in approaching syncope, this fact may be observed.

ſtem to a greater or leſs degree. As it is certain, that no two actions can be ſeparately performed by the ſame part at once, more than the tongue can articulate two languages at the ſame moment *, it follows, that the new action, thus induced by foreign agents, muſt be a complication of the new action with the natural one; or, to ſpeak more properly, the natural action becomes modified by the new ſtimulus; and the more that this action is changed, or becomes diſeaſed, the more muſt the part ſuffer. From obſervation fourth, it will appear, that the production of energy muſt be thus injured; and it will be at once evident,

* Although no two actions can exiſt ſeparately in the ſame place, and at the ſame time, yet they may ſometimes become blended, producing an action different from either. Some actions, however, cannot be thus blended, but the one will either diſplace the other, or will not take place at all.

that if health and ſtrength conſiſts in the due exiſtence and performance of the natural action, if this action be changed, weakneſs and diſeaſe muſt be the conſequence; and, likewiſe, that theſe diſeaſes are moſt dangerous in which the action is greatly changed; whereas, in theſe in which it is leſs altered, the danger is leſs, and they may ſubſiſt longer without producing death.

Sixth, It is neceſſary, that every new agent, or ſtimulus, ſhould have a certain degree of ſtrength; or, in other words, poſſeſs a certain quantity of the peculiar power by which it operates, in order to act upon the living ſyſtem; becauſe the natural action, if I may uſe the expreſſion, keeps its ground, with a certain degree of tenacity, and will only yield to a certain force. For example, a grain of ipecacuan, a drachm of glauber ſalt, a

drop of laudanum, or contagious matter, much diluted, will produce no effect upon a man. Were this not the case, we never should enjoy health; because the small quantity of contagious matter, which we may suppose to be often contained in the air, should uniformly affect us. The less energy that a person has, the weaker is the natural action; and, the weaker that the natural action is, the easier is it changed, or destroyed. Hence, the child is more easily injured than the adult; and he who is reduced by fatigue, abstinence, or previous disease, than the healthy and robust man. This law likewise obtains, with regard to the actions of sense, as every one knows who has attended to the phenomena of seeing, hearing, tasting, &c.

Seventh, Certain agents, which may have strength enough (by which I mean capability) to change the natural action,

will not be ſufficient to affect it, if it has already been modified by the previous application of a different agent. It is on this account that contàgions often fail, at particular times, to produce their effect: Becauſe the preſence of ſome other agent has previouſly modified the action, more or leſs; and, until the effects of this be gone off, no new diſeaſe takes place, unleſs the new ſtimulus be very diſſimilar indeed to that which induced it. We have an inſtance of the one caſe, in ſmall-pox not diſplacing meaſles; of the ſecond, in mercury deſtroying the venereal action.

EIGHTH, The agent in general operates moſt on the part to which it is immediately applied, if that part be ſuſceptible of its operation, and in a leſs degree upon neighbouring parts. The degree, however, to which theſe agents may extend their action,

is very various. Some, for inſtance, when taken into the ſtomach, extend their action over the whole ſyſtem, whilſt others act only upon the ſtomach itſelf, and produce no effect on the reſt of the body, except ſuch as take place in conſequence of the ſympathy of equilibrium. When heat is applied to a part, it inflames that part, but acts likewiſe, in a leſs degree, on thoſe which are near it; ſo that if one ſpot, to which moſt heat was applied, mortifies, or forms an eſchar, thoſe near it ſhall only exhibit a moderate degree of inflammation. Cantharides likewiſe extend their action beyond the ſpot to which they are applied, but in a much leſs degree than heat. Contagions, however, producing ſpecific inflammation, are more confined in their operation than ſimple inflaming cauſes. Specific inflammation generally terminates more abruptly; that is to ſay, it does not diffuſe

itſelf ſo far as ſimple inflammation; but ſometimes it is ſurrounded by ſimple inflammation. Thus the variolous inflammation is ſurrounded by a ſimple eryſipelatous inflammation.

Ninth, The impreſſing cauſe, or ſtimulus, muſt not only be of a certain ſtrength, but it muſt alſo be applied for a certain length of time before it can produce its effect. That ſome time is neceſſary for the formation of an action is evident; becauſe, ſetting all other reaſons aſide, we obſerve a certain interval betwixt the firſt derangement of the natural action and the appearance of the new action, in its full and proper ſtate. This period of formation is always marked by ſymptoms of weakneſs, ſuch as laſſitude and chillineſs; and the effects of impaired functions, ſuch as anorexia, thirſt, and head-ache, even although the action, when

fully formed, ſhould be ſuch as to require bleeding, and what are called ſedatives, as we ſee illuſtrated by the hiſtory of inflammation. Theſe ſymptoms do not precede thoſe actions alone which are called diſeaſed; for we find ſimiliar effects produced during the formation of thoſe actions which are afterwards to become permanent and natural. Thus the child during dentition, the young animal during the ſhooting forth of his horns, the peacock when he gets his creſt, and the turkey when the fleſhy excreſcences on the head are formed, have all a diminution and affection of the natural action, producing diſorder of the ſyſtem, and ſometimes even death itſelf. The time which is required for the formation of theſe actions is various; nor can the exact duration, in every inſtance, be eaſily aſcertained. It may, however, be obſerv-

ed, in general, that the more diſſimilar the new action is to the old or natural one, and, conſequently, the more dangerous that it is, the ſooner is it formed*; but as many cauſes (particularly the previous exiſtence of other actions, or modifications of the natural action, although ſo ſlight as not to be much attended to) may tend to interrupt and poſtpone the eſtabliſhment of the action, the period of formation in the ſame action may be different at different times. And, farther, as the conſtitution or natural action of no two people are exactly alike, the time of formation will vary in different people; and, in ſome, particular actions may never, or very ſeldom take place, although

* The fevers, vulgarly called putrid, that is, very bad fevers, come on with a ſhorter cold fit than thoſe which are milder. The poſition is likewiſe illuſtrated by many other diſeaſes.

they be fully expoſed to the exciting cauſe *.

But beſides this time which elapſes during the formation of an action before it fully appears, there is likewiſe an interval betwixt the application of the cauſe and the commencement of the formation; but this is much leſs in ſome diſeaſes than in others. It is natural, however, to ſuppoſe, that this interval bears ſome proportion to the quickneſs of the formation. The contagion of very bad typhus fevers, for inſtance, operates much ſooner than that of the common nervous fever, as it is called.

A knowledge of the different times required, by certain agents, to produce

* Some people are much leſs ſubject to fevers, to ſyphilis, &c. than others; and ſome never take the ſmall-pox

theſe effects, is of no ſmall importance, becauſe we may thus be able to eſcape their action, in many caſes. By waſhing off ſome contagions ſhortly after their application, we prevent the diſeaſe, as we ſee illuſtrated by ſyphilis. In caſes where poiſons are taken into the ſtomach, we can preſcribe an emetic, which operates more quickly, and thus removes them; and, for this purpoſe, we employ white vitriol rather than emetic tartar, becauſe the one acts more ſpeedily than the other.

TENTH, The ſame ſtimulus will always produce actions radically the ſame; but varying the degree of ſtimulus will often ſo affect the action, as to make it apparently different. Thus heat, in a ſmall degree, makes the natural action be carried on more perfectly, and gives pleaſure; but, in a greater degree, it in-

creaſes the action ſo much, as to change its appearance, or viſible effects and ſymptoms, producing inflammation, which, from analyſis, we learn to be an increaſe of the natural action.

ELEVENTH, The action remains for ſome time after the agent is withdrawn. If this were not the caſe, we ſhould always be able to cure a diſeaſe, by removing the exciting cauſe, which no one expects to be able to do. Removing a bliſtering plaſter, for inſtance, will not immediately remove the inflammation which it has produced. There is, however, no certain rule for the duration of theſe actions; becauſe one continues much longer than another; and ſome ſeem even to have no tendency to decreaſe or diſappear after any duration, however long *.

* It is impoſſible, in the preſent ſtate of our knowledge, to aſcertain the immediate cauſe of this. We cannot, for

Twelfth, All actions affect one part of the body more than the rest. Sometimes there is only one organ affected, producing a disease entirely local; at other times, the whole system suffers, but, in this case, there is always one part in which the action chiefly exists.

All morbid actions, which are extended over the system, affect the circulation, and produce frequency of pulse; and, when fully formed, heat of the skin. These, when concentrated in any part, or when they affect any organ to a great degree, produce a species of inflamma-

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instance, say why the variolous inflammation subsides spontaneously in a few days, whilst the venereal action remains unabated through life; neither can we tell why the action induced by opium subsides in a few hours, whilst that of typhus continues for days; why some actions disappear and return alternately, for a length of time, and others remain constantly the same.

tion; and it is eaſy, from the connection of the inflammatory action with the ſtate of the veſſels, to ſee how this ſhould take place. If the action exiſts to leſs degree than this in the part, then it does not produce inflammation, but only pain, and a ſtate bordering on inflammation.

Thirteenth, When ſpecific inflammation is induced in any part, the ſuſceptibility of the neighbouring parts, for aſſuming this, is leſſened; and they ſeldom do aſſume it, unleſs ſome ſtimulant be applied to them. Thus, a certain number of puſtules are produced in ſmall-pox, by which the reſt of the ſurface is leſs ſubject to the variolous inflammation. If, however, other ſtimulants be applied, ſuch as heat, then, notwithſtanding the diminiſhed ſuſceptibility,

the inflammation is excited, and a great eruption is produced.

Fourteenth, Thoſe agents which induce actions nearly ſimilar to the natural one, or which change its nature little, at leaſt comparatively ſpeaking, may be called agentes ſimiles: Theſe, which have alſo been named ſtimulants, uniformly produce weakneſs, after their operation is over, unleſs it ſubſide very ſlowly, and thus allow the natural action gradually to regain its perfection before their artificial action diſappears, and, conſequently, before the ſyſtem can be reduced to an inactive condition, as we ſee in the effects of great and ſudden muſcular exertions, which weaken more than a long continued, but gentler action, though this, in the ſum, be greater than the other.

As theſe actions reſemble, in ſome degree, the natural action, they alſo, in ſome degree, ſupply its place; and we often do not ſo readily, during their continuance, perceive the weakneſs which they induce; but, at other times, we can readily detect its exiſtence, at leaſt in particular functions. Thus, for inſtance, the preſence of inflammation uniformly impairs the function of the inflamed part, as we ſee in the caſe of muſcular motion, which is diminiſhed in rheumatiſm; for, independent of the pain, we could not make the ſame exertion as formerly; and, in ſynocha, we cannot walk, nor eat, nor do what we uſed to do. If, however, the action be ſtill more nearly reſembling the natural action; or, if the nature of the healthy action be ſtill leſs changed, then we do not perceive the weakneſs as long as it continues, as we ſee in the caſe

of the vinous action; on the contrary, the person can make a greater exertion during it, because it differs very little from the natural action *.

When the action of any part is much increased, its power is expended; and, therefore, in order to prevent farther weakness, after the operation of the stimulant is over, we find, that the action of the system is diminished in proportion to the diminished power, and both are

* According to the Brownonian doctrine, stimulant actions should not produce weakness until their operation be over. But experience proves, that the reverse is the case; and I have endeavoured to show why it does not appear in every period of an action, and in which actions we are to expect it. We do not observe it in the vinous action, if it exist only in a slight degree; but if it be greater, it becomes evident. We observe it uniformly in inflammatory diseases, and, indeed, during the continuance of every stimulant action, if it be induced to a considerable degree.

only ſlowly increaſed or renewed. This fact is overlooked by the Brownonians, who give ſtimulants in this caſe, as they ſay, to increaſe the excitement. But this practice is evidently improper, in moſt caſes; and, where it is admiſſible, the quantity of ſtimulus muſt be very ſmall, and muſt be of ſuch a kind as tends to excite the natural action of the part; as, for inſtance, ſoups for the ſtomach, &c.

The more quickly that the ſtimulant action is induced, and the greater its degree, the more quickly does the weakneſs appear, and the greater is it. This evidently muſt be the caſe; becauſe action requires power or energy *; and the more quickly that it is raiſed, the leſs

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* It is eaſy, from this, to ſee how weakened parts ſhould bear diſeaſe worſe than the ſtrong.

able is the nerve to ſupply this energy*. When a part is ſcalded with water, there is a very great action inſtantaneouſly induced; and, therefore, there is a weakneſs of the part very quickly induced; and the inflammation requires the application of gentle ſtimulants for its cure, as will be afterwards mentioned. If the degree of heat has been ſtill greater, then immediate death, or mortification of the part, takes place, and an eſchar is formed.

From theſe remarks, it is evident, then, that increaſed action, in conſequence of the application of ſtimulants producing diſeaſes, as well as an increaſed exerciſe of particular functions, will produce

* One cauſe of this, amongſt many others, is, that the more abrupt the tranſition is, from one ſtate to another, the more is the function injured.

weakneſs, which will be ſenſibly perceived, unleſs the ſtimulant action very nearly reſembles the natural one, and ſubſides very gradually. The vinous action, unleſs it has been moderate, and, conſequently, leſſens gradually, produces weakneſs; muſcular exertion fatigues; too much food taken into the ſtomach weakens it, and vomiting, or temporary dyſpepſia, take place; heat overpowers the ſyſtem, and cauſes fainting.

Fifteenth, Thoſe agents which induce actions very diſſimilar to the natural action, may be called diſſimiles, and produce great weakneſs very quickly; whereas, in many inſtances of ſtimulant actions, when they do not ariſe to a great degree, the ſenſible weakneſs is not perceived for a conſiderable time, and until the ſtimulant action has ſubſided.

THE agentes diſſimiles, or what have been improperly called ſedatives, may, like the agentes ſimiles, or ſtimulants, induce very violent actions, and will often require the uſe of ſuch remedies as tend to abate action in general; ſuch as, cold and blood-letting. Theſe actions are always attended with an inflammatory affection, when they exiſt, in a great degree, in any organ. That typhus is always attended with an inflammatory affection of the head, and ſometimes of the lungs, or abdominal viſcera, muſt be acknowledged by every one, who is converſant in diſſection: That the plague and yellow fever are attended with inflammation, is equally certain: That lead induces inflammation, is ſo well known, that bleeding is frequently uſed, with ſucceſs, in the cholic which it produces: Laurel water produces an inflammatory or hemorrhagic action of the brain, marked frequently by

delirium, red eyes, and turgidity of the veſſels. It muſt, therefore, appear, that the medicines, called ſedatives, have no title to that appellation, which belongs only to ſuch agents as tend to abate action in general; and, therefore, can only be properly applied to veneſection, and cold, and abſtinence, which, under certain circumſtances, abate action, not indeed by any poſitive power, or peculiar quality, but negatively, by removing cauſes, which keep up action.

Notwithstanding the utility of bleeding, in the beginning of many actions belonging to this claſs, it yet muſt be remembered, that the practice is hurtful, if employed too late, and after any very conſiderable weakneſs is induced, by the continuance of the diſſimilar action: Oppoſite remedies will then be of uſe.

The actions belonging to this clafs are by much the moft dangerous, as will appear from one or two examples.

When a perfon is bit by a ferpent, we invariably find very great weaknefs produced, with more or lefs rapidity. The countenance becomes pale, a tremor feizes the whole body, the breathing becomes hurried and oppreffed, and the pulfe weak and irregular; convulfions clofe the fcene. Thefe are the general effects of the bite of venomous animals; but we find different modifications taking place, according to the fpecific difference of the poifon. The bite of fome ferpents is fatal in lefs than an hour, whilft that of others does not kill for a much longer time. Some produce violent convulfions, others a ftupor; fome caufe excruciating pain, whilft others kill with an eafy infenfibility.

The poifon generated by rabid animals, is likewife a very powerful agens diffimilis, producing great languor and dejection, and weaknefs of all the functions, attended with fpafmodic affections of the mufcles, and particularly of thofe of the throat, which become convulfed, from very flight caufes.

The diffimilar agent, however, which we moft frequently meet with, is the contagion of typhus fever, concerning the nature and operation of which there have been many difputes. Some have confidered the putrefaction of animal and vegetable matters, as the caufe producing contagion; others have referred it to an unknown ftate of the air; others, to certain alterations in the atmofphere, which might be afcertained and imitated by chemical proceffes; whilft fome have denied altogether the

exiſtence of typhus contagion. There have been ſtill more diſputes about the nature of the diſeaſe, which this contagion induced. Some called it the effect of fermentation; others, of ſpaſm; others, of pure weakneſs; but the wiſeſt part of phyſicians allow it to be a peculiar action, which they cannot imitate or produce, by any of thoſe general cauſes.

As all theſe agents produce great weakneſs, it might be ſuppoſed, that the cure ought to conſiſt entirely in preſcribing, from the very firſt, ſuch medicines as would tend to produce an action as nearly ſimilar to the natural one as poſſible; ſuch as wine, or other fermented liquors. But it is to be remembered, that, in the firſt place, thoſe actions will not, in the beginning, yield to the natural one: They have already deſtroyed

it; and, therefore, it is not to be expected, that ſuch agents, as tend only to excite an action ſomewhat ſimilar to the natural one, ſhould be capable of diſplacing theſe.

There is, however, a ſtill more ſerious objection to this practice: The propoſal is made, without attending to the circumſtance of, what are called, ſedative actions, being, in their commencement, ſometimes ſo violent *, as to require the application of ſuch cauſes as tend, in general, to abate all actions indiſcriminately; ſuch as bleeding, and the uſe of cold, to a moderate degree. It is like-

* There is, in the beginning of theſe actions, a ſtate ſomewhat approaching to the condition in inflammation; and this ſtate, of violent or increaſed action, continues longer or ſhorter, in different ſedative actions. In ſome, it laſts only a few hours, and theſe are the moſt dangerous.

wiſe to be obſerved, that as wine cannot diſplace the typhus action at firſt, it will, by its operation, tend to increaſe it; and as both the contagion and the wine act more upon the head than on other parts, in proportion to their ſize, it will readily be ſeen, why the early uſe of wine, in fevers, ſo frequently produces phrenitis; for it has been already mentioned, that whenever any action was much increaſed, or concentrated in a particular part, it induced a ſpecies of inflammation. Wine, however, is uſeful, after the firſt ſtage of the diſeaſe is over, and the more immediate violence of the action has ſubſided, and the weakneſs is making progreſs againſt us. In this caſe, it is as uſeful, as it formerly was hurtful.

SIXTEENTH, Removing the ſenſible effects of any particular action, has a tendency to deſtroy the action itſelf.

Thus, ſuch applications as abate the pain of the head, in typhus fever, tend to abate the fever; ſuch as abate the heat in inflammation or fever, abate theſe diſeaſes. This is called practiſing according to ſymptoms, and is a method, at all times, to be followed, even in the cure of thoſe actions or diſeaſes, for which we poſſeſs ſpecific remedies, as the operation of thoſe remedies will be greatly aſſiſted by it.

SEVENTEENTH, Diſeaſes are often cured alſo, by removing the particular ſtate of the ſyſtem, which gives to them their peculiar inveteracy or danger *. Thus, inflammation of weakened parts is removed, by ſtrengthening the part; that is to ſay,

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* Diſeaſe is often ſo connected with the ſtate of the ſyſtem in which it occurs, that removing that ſtate of the ſyſtem, ſhall remove the diſeaſe.

increaſing its energy ; which we do, by ſuch remedies as act on the whole ſyſtem, at the ſame time that we apply ſuch agents to the part itſelf, as ſhall tend to change the action. It may be thought, that increaſing the action of the ſyſtem, in this ſpecies of inflammation, ſhould be prejudicial, and ſhould increaſe the inflammatory action ; becauſe this was perhaps originally produced by the communication of action from the neighbouring parts: But the remedies which we employ, tend not to induce an inflammatory action in thoſe parts, but one more nearly reſembling the natural action, and thus augment the energy, and diminiſh the inflammation. If, however, the inflammation has happened from a morbid increaſe of action, in a part already ſtrong, then ſuch remedies as tend to increaſe this ſhall do harm.

Eighteenth, Actions which are ſuddenly induced, in healthy parts, are more dangerous than thoſe which are excited more gradually; or, in other words, the more ſpeedy the tranſition is, from health to diſeaſe, the more does the animal ſuffer. It is, for inſtance, obſerved, that people bear amputation better, if it be performed on account of ſome diſeaſe of long ſtanding, than if we operate on account of ſome ſudden accident; one cauſe of which is, that the conſtitution had formerly been accuſtomed to a diſeaſed ſtate, or inflammatory action; and, therefore, ſuffers leſs by the one which our operation induces.

Nineteenth, The more the ſyſtem, at the time of the application of any new agent, approaches to the general condition which that agent tends to induce, the more dangerous will the ac-

tion of the agent be, and the more readily will it operate. Thus, typhus fever tends to produce great weakneſs, and, therefore, will be more dangerous when it attacks thoſe who have been formerly much reduced than thoſe who have not. Thoſe, again, who are very vigorous, may be ſaid, as Mr. Hunter obſerves, to have their action as high as it can be without diſeaſe being induced; very trifling cauſes may, therefore, operate on them. Inflammation will be very high in them; and wounds, or accidents, extremely dangerous. They will even be more eaſily acted on by the agentes diſſimiles, or ſedatives, as they have been called, than thoſe whoſe action is leſs, and nearer the proper medium, becauſe they are more eaſily rendered diſeaſed, and the inflammatory ſtate which theſe agents tend to excite will be more violent in them.

Twentieth, Contiguous parts ſympathiſe with each other to a certain degree. Hence, if the action of any part be increaſed, the increaſe ſpreads in a leſs degree to the neighbouring parts, unleſs theſe parts exhibit the ſympathy of equilibrium; ſuch as the ſkin and liver, for inſtance. Hence alſo, if a part be weakened by cold, the action of the neighbouring parts ſpreads to it after the cold is withdrawn, and communicates to it a greater degree of action than its weakened ſtate can bear; the conſequence of which is inflammation, which ends frequently in gangrene. Upon the ſame principle, a part draws ſupport from the contiguous parts, and bears diſeaſe much longer, on this account, than it otherwiſe would do. Hence, when cauſes act locally on a part, in ſuch a way as to kill it, the neighbouring parts are weakened;

or, if it be a large part which is affected, the whole ſyſtem is injured.

Twenty-first, When an increaſed action is induced in one part, it has a tendency either to diminiſh action in ſome other part, or to increaſe it for a time in that part, according to circumſtances, which have been already explained in treating of the ſympathy of aſſociation, and the ſympathy of equilibrium. Contiguous parts, of a ſimilar ſtructure, moſt frequently exhibit the ſympathy of aſſociation, and the action ſpreads more rapidly in them; contiguous parts, of diſſimilar ſtructure, exhibit, in the ſame circumſtances, moſt frequently, the ſympathy of equilibrium. It is evident, therefore, why all local actions extend themſelves fartheſt, and moſt quickly, in thoſe parts which are ſimilar to the ſpot in which they commenced. Hence, as Mr. Hun-

ter has obſerved, when one portion of a gland becomes inflamed, the reſt alſo becomes quickly inflamed; but the ſurrounding cellular ſubſtance, or ſkin, is much longer of becoming affected. Hence, alſo, we may ſometimes check the progreſs of ſome cutaneous actions, by applying cauſtic round the diſeaſed ſpot, ſo as to incloſe it as with a ring; for the morbid action does not extend itſelf deeper than the ſkin, and it does not overleap the deſtroyed or altered ſubſtance produced by the cauſtic; it is therefore checked.

TWENTY-SECOND, Contagious matter, generated by animals, has a greater tendency to affect animals of the ſame ſpecies which produced it, than others; and the ſame parts in another individual which have produced or ſecreted it in one, rather than parts of a different nature. Thus, the contagious matter pro-

duced by the glands of the urethra in gonorrhœa, has a greater tendency to affect other ſecreting parts, than parts which do not ſecrete.

Twenty-third, Whenever an accuſtomed ſtimulus is withdrawn from a part, or the whole, the action becomes imperfect and irregular, becauſe an agent which was wont to contribute to its production is abſent. This produces pain; for all new and irregular actions excite diſagreeable ſenſations.

Twenty-fourth, The mind has the capability of perceiving and taking cogniſance of the actions of the body; but if theſe actions be conſtantly repeated, we at laſt do not perceive them, or receive any ſenſation. Thus, we have no ſenſation from the performance of all the healthy functions, or parts of the natural

action; or from the motion of the heart and arteries. But if the action be either imperfect, or in any respect new, then it produces a sensation, which, if violent, we call pain *. If the heart contracts irregularly, or in a different manner from what it formerly did, then we feel it, and call it palpitation. All new general actions are attended with an indescribable uneasiness. When an ulcer is painful, we may be certain that the healing action is not going on; and, according to observation sixteenth, we may often cure it by such remedies as tend to abate the pain.

* We are not always to judge of the danger of an action by the pain which it produces, because some slight imperfections and irregularities in the action of a part will produce a much more acute sensation than some very dangerous actions. It is an old observation, that pain without inflammation may be borne long without very great injury to the system.

Twenty-fifth, Some actions are continued by habit alone. Any action which has continued long becomes in a manner natural, that is, excited and supported by the natural agents which were operating when it was first induced, and during the continuance which the action *necessarily* had on account of the strong action of the original exciting cause. Many actions are thus kept up longer than they otherwise would be, and may then be interrupted by causes which, formerly, would not have operated to produce this effect. Other actions are said to be renewed, or restored by habit; an explanation of which has been already given.

Twenty-sixth, All general actions exhibit a certain revolution, or exacerbation and remission, at particular times or periods. In a state of health, we observe,

that the power or energy of the ſyſtem is greateſt, and the action moſt perfect, in the morning. In the evening, the action is more imperfect, and the power leſs, in ſo much, that, in very weak people, we even find a degree of fever induced. During reſt *, the performance of the functions, or the different parts of the natural action, is leſſened, and the operations of the mind, which conſume much energy by their continuance, are lulled or ſuſpended. There is then a regular revolution, which muſt take place from the very firſt day in which we begin to obſerve regular periods of ſleeping and working †; and this, by long continuance,

* Man, in a ſtate of nature, would naturally ſuſpend his operations when the ſun ſet, even although he was not led to do ſo from fatigue. He works through the day by the light of the ſun; and retires, during the darkneſs of the night, to reſt from his labours.

† In the infant, there are no regular periods for retiring

and frequent repetition, comes to be ſo permanently eſtabliſhed, that, even although we remain the whole twenty-four hours without exertion, and in a recumbent poſture, we ſhould be ſenſible of the changes. This revolution, which takes place during health, continues alſo, by habit, during diſeaſe, although no greater exertion be made during the day than during the night; and, hence, we may account for the greater frequency of the pulſe, and the exacerbation of many diſeaſes toward the evening. The ſame obſervation may alſo teach us, why we not unfrequently perceive remiſſions toward the evening, in diſeaſes of an inflammatory nature; becauſe the natural action is naturally leſs toward night; and, as

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to reſt; but the child ſleeps repeatedly during the twenty-four hours, at no ſtated intervals. The younger the child, the more ſleep is required; that is to ſay, the leſs action can it ſuſtain.

the inflammatory action, in healthy people, consists in a morbid increase of the action, we may understand how there should be a diminution of this at night. The pulse, in acute rheumatism, is often quicker through the day than in the evening: But if the inflammation be of a different kind, it may be increased by the same cause which, in acute rheumatism, diminished it. Inflammation of strong parts, in healthy people, is increased by whatever increases the natural action, and vice versa; but inflammation of weakened parts, or in reduced and weak bodies, is diminished by whatever tends to improve and strengthen the natural action. The one disease will be worse, the other better in the day than at night.

The state of the sun, but particularly the moon, with regard to our planet, likewise affects the human body; and the

way in which it does ſo has been already mentioned. When the attractive power of the moon operates moſt, the actions of the ſyſtem, whilſt healthy or diſeaſed, are moſt excited, that is to ſay, there is at that time an agent acting in a greater degree upon the body than at another time; and, conſequently, the action muſt, at that time, be greateſt. When the attractive power is leaſt, diſeaſed actions are moſt eaſily overcome, if all the other cauſes be alike; but, if other cauſes interfere, as often happens, this diminution will not be perceived. If this account be true, we ſhall ſee why, at certain periods of a lunation, diſeaſes ought to ſubſide moſt; but every diſeaſe, in every perſon, will not ſubſide equally; for thoſe which have recently commenced, will not be ſo much diminiſhed as thoſe which have continued longer, and are nearer their natural termination. If, near the end of a

difeafe, the termination may be haftened by the diminution of the attraction of the moon; if, on the contrary, the difeafe be increafing, it will be aggravated by the other ftate of the moon, in which it acts moft, and may thus prove fatal fooner than it otherwife would do *. This being the cafe, I do not fee that the doctrine of critical days can be explained by this general principle, which muft either be allowed to act equally on all, and produce a crifis in every difeafe on the fame day; or, as I have fuppofed, muft operate differently according to the ftate of the disease, without any reference to the completion of a regular period, or certain number of days.

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* The increafed attraction of the moon will operate moft vifibly on the difeafes which are increafing, whilft the effects of diminifhed attraction will be moft perceptible when the difeafe is declining.

Conclusion.

FROM the whole hiſtory of the nervous ſyſtem, its properties appear to be wonderful indeed, and its delicacy ſeems to be ſo great, that we would at firſt ſuppoſe, that it ſhould be perpetually ſubject to derangement, from the action of even the moſt trifling cauſe. But by a more attentive examination, we perceive here, as in other caſes, with admiration, the workmanſhip of an infinitely wiſe and powerful Creator, who has eſtabliſhed ſuch laws in the animal economy, that, in many caſes, theſe hurtful powers operate for their own deſtruction. When a foreign body is applied to the noſe, it is expelled by ſneezing: When it gets into the eye, the lachrymal gland, by its ſti-

mulus, pours out more tears, and the ſub-ſtance is waſhed out: When cantharides are applied to the ſkin, the cuticle becomes elevated, and the ſource of irritation is removed far from the true ſkin; or, if it ſhould reach to it, pus is ſoon formed, and the ſtimulus is again removed, more diſagreeable effects being thus prevented. When a hurtful matter is received into the ſtomach and bowels, its firſt operation produces vomiting or purging, and thus cauſes its own expulſion, as is ſometimes ſeen in over doſes of arſenic, or other poiſons. When much of the ſkin is inflamed, the action of the internal parts is diminiſhed, the action of the heart is weakened, and the blood is ſent leſs forcibly to the ſurface. The inflammation, which would otherwiſe ſoon have terminated in mortification, thus more readily admits of reſolution. When, on the other hand, the action of the cu-

ticular nerves is weakened, the heart has its action increased, the blood is more powerfully propelled, and the nerves of the surface are soon again stimulated to their proper action. Equal nicety is displayed in the natural actions of the different parts of the animal. When, for instance, the light is faint, the iris opens to admit the most to the retina; but when it is vivid, then the iris contracts, and allows a smaller portion of rays to enter.

These properties of the animal evince so much wisdom, that many have been led to imagine, that some intelligent agent presided in the system, and regulated all its actions. This agent has, by some, been believed to be the rational soul, and, by others, a certain preserving power of nature; and, accordingly, the vis conservatrix naturæ has, at all times, held an

eminent ſituation in the ſchools of phyſic. But the truth is, that the nervous ſyſtem is ſo formed, that theſe happy effects take place regularly from the immediate action of ſtimuli, and not by the intermedium or direction of any third power. We are, accordingly, not led up to any viſionary archeus, as a ſource of action; but we are directed to admire the wiſdom of the ALMIGHTY FRAMER of man, who eſtabliſhed, in his ſyſtem, the laws by which theſe operations are produced, when he "breathed the breath of life "into his noſtrils."

NOR is this all which we have to admire in the economy of life; for the whole hiſtory of it is full of wonder; from the womb even to the grave. The conception of the fœtus; its growing from the uterus, like the leaf from the plant; connected to its parent by only a very

ſlender veſſel; its increaſing by the nouriſhment of the mother; and its union with an *immaterial* and *immortal* ſpirit; are all myſterious, and truly wonderful points; but not more ſo, than its receiving, after birth, foreign matters into the ſtomach; its changing their life into its own, and converting them finally into a part of itſelf; its gradual increaſe from an imperceptible point to a full grown creature; and its equally ſlow and regular progreſs from maturity to diſſolution; are topics which are, indeed, worthy to be ſeriouſly contemplated by the moſt exalted mind.

"Fearfully and wonderfully are we
"made."

DISSERTATION II.

ON

SIMPLE INFLAMMATION,

And its Conſequences.

Of the Definition and Diviſion of Inflammation.

By the term inflammation, is generally underſtood that ſtate of a part, in which it is painful, hotter, redder, and ſomewhat more turgid, than it naturally is; which topical ſymptoms, when preſent to any conſiderable degree, or when they affect very ſenſible parts, are attended with fever, or a general diſeaſed action of the ſyſtem.

The most obvious division of the action of inflammation, is into that affecting strong and healthy parts, and that affecting those which are weak; and, therefore, the order inflammatæ will consist of two genera, the inflammatio valida, and the inflammatio debilis: The specific distinctions will be the same in both of these genera, being founded upon the part affected: The varieties depend upon the duration and activity of the action: That which runs its course rapidly and actively, is called inflammatio activa, sive acuta; that which continues longer, and seems to have become, in a manner, habitual to the part, is termed inflammatio passiva, sive assuefacta. Some of the species will naturally admit of only the first variety.

It is the inflammatio valida et acuta which is here to be considered at greatest

length: The inflammatio debilis will come to be attended to, in examining the cauſes and treatment of mortification: The little which is neceſſary to be ſaid concerning the inflammatio aſſuefacta, will be mentioned in the concluſion of this diſſertation.

Of the Stages and Terminations of Inflammation.

In every extenſive inflammation, we may always obſerve two ſtages, which are marked by different ſymptoms, thoſe of the one being common to every new action, during its formation, whilſt thoſe of the other are peculiar to the diſeaſe at preſent to be conſidered.

In the firſt ſtage, the patient is weak and languid, and complains of coldneſs;

the pulſe is frequent and ſmall; the tongue parched; the head ſomewhat confuſed or pained, and the functions of the ſtomach deranged.

In the ſecond ſtage, the pulſe becomes harder; the thirſt continues; the coldneſs is ſucceeded by heat, and the patient becomes reſtleſs and uneaſy. Whenever theſe ſymptoms appear, the local diſeaſe manifeſts itſelf, and keeps pace with the general affection: The part becomes red, painful, and ſwelled*, at the ſame time that its function is impaired.

When this topical affection ſupervenes, the fever ſeldom, except in ſome ſpecific diſeaſes, abates; but, on the contrary, often becomes more violent, and conti-

* The ſofteſt parts ſwell moſt: thoſe which are harder ſwell leſs, with the ſame degree of inflammation.

nues until the local diſeaſe be either removed, or its nature be changed.

When inflammation is ſuddenly produced by any powerful cauſe acting locally, we find, that the local affection comes on firſt, after which the febrile ſymptoms appear. If, however, the local complaint be ſlight, and induced by a trifling cauſe, we do not find, that any general diſeaſe is induced, but the affection is entirely topical.

When the fever does not come on until after the eſtabliſhment of the inflammatory action in a part, it is called ſymptomatic, being dependent entirely on the local affection: But when the fever precedes the topical inflammation, or is coeval with it, then it is ſaid to be idiopathic, being produced by the direct operation of the ſame cauſes which induce

the topical difeafe. In all cafes, perhaps, the fever becomes fymptomatic in the end.

WHEN the local inflammation can be removed, without any very remarkable change being induced in the part, it is faid to be refolved, or to terminate by refolution; a term which originated from the ancient doctrines on this fubject. This is known to have happened, by the diminution at firft, and afterwards the complete removal of the different fymptoms, whilft the part flowly returns, apparently, to its natural figure, although, moft* frequently, there are adhefions formed with the contiguous parts.

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* Adhefions are formed in every inftance where the inflammation is produced by mechanical injuries: but where it depends upon fome general caufe, adhefions do not always take place. This is exemplified by rheumatifm, where adhefions are not neceffarily produced.

When the pain, heat, and rednefs, difappear, but the part remains hard and fwelled, the inflammation is faid to end in fchirrus. This termination is moft frequent in glandular parts.

If, on the contrary, the pain, rednefs, and heat, continue great for fome time, and then abate, the firft becoming ftill more of the pulfatory kind, at the fame time that the part remains fwelled, but becomes gradually foft and fluctuating, and efpecially if this change be preceded by chillinefs, we may be certain, that the ftructure of the part is deftroyed, and a new fecretory action eftablifhed, producing pus, which fills the cavity formed by the deftruction of the inflamed parts. In this cafe, the inflammation is faid to terminate by fuppuration: At other times, efpecially in inflammation of membraneous parts, which, in health,

ſecrete a particular fluid, a liquid, different from pus, and reſembling more the natural ſecretion of the part, is formed. In this, as in the other caſe, the inflammation diminiſhes; but the patient has ſeldom any chills; nor is the ſtructure of the part injured, at leaſt farther than by mere diſtenſion, if it be a cavity. The functions of the part are, however, often injured, from the preſence of the fluid. This termination, which has been improperly called effuſion, is not unfrequent in pulmonic affections, producing hydrothorax: It likewiſe produces the thick diſcharge from the noſe, in catarrh, and the purulent looking diſcharge which takes place from the urethra, after the application of acrid matters.

Lastly, Violent inflammation in a part may kill it, in which caſe it is ſaid to end in mortification. We are to ap-

prehend this termination, when the inflammation is very violent, compared to the power of the part, and when it manifests no tendency to any of the other terminations. We are ſtill more to dread it, when the colour of the part becomes of a darker hue, and the pulſe more frequent and feebler, at the ſame time that the general ſtrength ſinks. In theſe circumſtances, if the diſeaſe be not checked by proper remedies, the mortification ſoon appears: The part becomes firſt of a purple, and then of a black colour: It loſes its heat; the cuticle riſes up in bliſters, and the part ſoon becomes ſoft, putrid, and quite ſenſeleſs. This termination does not take place without much pain; for although the part, after it mortifies, has no feeling, yet, during the proceſs, the ſenſation is very acute; and, even after the mortification is complete, the parts in the immediate vicinity are

exceſſively irritable, being nearly in the ſame ſtate in which the mortified part was before it died.

When the mortification affected only the cellular ſubſtance, it was ſuppoſed to be of a milder nature, and was called gangrene; but when it penetrated deeper to the muſcles or blood-veſſels, it was called a ſphacelus.

Of the Exciting Cauſes of Inflammation.

Whatever increaſes the action of a part, beyond that relation which ought to ſubſiſt betwixt the action of a part and its power, is productive of inflammation. The cauſes which effect this may be divided into two claſſes; firſt, thoſe which act directly on the part to which they are applied; ſecond, thoſe

which are not applied to the part which becomes inflamed, but which act indirectly on it.

The first kind admits of two divisions. First, those foreign agents which operate by what is called their stimulant power, such as cantharides, heat, &c. This operation having been already explained in the preliminary dissertation, it will be unnecessary to make any farther remark on it here. Second, those causes which act mechanically, such as bruises and wounds. Bruises act, I apprehend, in the same way with cold, when it appears to inflame the part to which it is applied; and, therefore, their action will be explained in considering the operation of cold. If wounds be put into a proper situation of uniting, we generally find, that no inflammation takes place; but the structure of the part is directly renew-

ed, by the operation of the ſame power which nouriſhes the part in health, and renews its ſtructure when abſorbed: But if from any cauſe this be prevented, then inflammation comes on, from which we may preſume, that the prevention of the action of nutrition produces the inflammatory action; for if, by removing the ſides of the wound from each other, or by any other cauſe, we inevitably prevent the natural action of depoſition, or nutrition, then the moſt trifling cauſe will induce the inflammatory action; even the circumſtance of being in an unuſual ſituation, will be ſufficient to excite the action to a morbid degree *. On the other hand, the preſence of the inflamma-

* Mr. Hunter ſuppoſes, that the "ſtimulus of imper-"ſection immediately calls forth the action of reſtoration," which is effected by means of inflammation.

Hunter on Inflammation. p. 190.

tory action, will be sufficient to prevent the action of nutrition, if it should be excited by the operation of the cause which produced the injury; for the wound is often inflicted in such a way, or with such pain, as to increase the action to such a degree as to form inflammation; and this cause will more especially operate, where we interrupt the uniting process, or action of nutrition: It is even often sufficient to cause inflammation, when we use every precaution to forward the uniting process. Cold is very often found to inflame the part to which it is applied; but it has not been deemed easy to give such an explanation of its action as would be applicable to every case. It was, at one time, supposed to operate, by producing stagnation of the blood or humours in the part; but the two opinions which I shall at present

mention are, firſt, that it acts as a ſtimulant; ſecond, that it acts as a ſedative.

In ſupport of the opinion, that cold is a ſtimulant, it may be urged, that it produces pain, when applied in too great quantity; that it reddens the ſkin, and often inflames the part on which it acts; and, finally, that it invigorates the ſyſtem, when applied in moderation.

It muſt, however, be evident to every one, that cold leſſens the action, either of the whole ſyſtem, or of a part, according to the mode of its application; and that, if it be long enough continued, it will produce, firſt, torpor, and then death. This is ſo fully eſtabliſhed, that it is unneceſſary to inſiſt upon it; and muſt prove, that cold is not a ſtimulant. Pain is produced, both by an increaſe and diminution of action; and, therefore, we

are not to be ſurpriſed, that cold ſhould be productive of a very unpleaſant ſenſation or pain. The abſence or diminution of any accuſtomed ſtimulus, muſt be productive of pain; and this pain will be violent, in proportion to the extent and continuance of the diminution. The want of food produces, firſt, ſlight uneaſineſs, and then more acute pain; and the ſame may be ſaid of heat. Whenever any natural and accuſtomed ſtimulus is withdrawn, the action of the part is performed irregularly, and becomes imperfect, which is always attended with a diſagreeable ſenſation: But, beſides this cauſe of pain, there is alſo another, which comes to operate after the cold has been applied for a conſiderable time, namely, that the action of the neighbouring parts is communicated by ſympathy to the cold part, which occaſions an action in it greater than the power can ſuſtain, and, conſe-

quently, produces a ſpecies of inflammation *. There are, likewiſe, ſeveral cauſes which may be applied at the ſame time with the cold, and which will tend to excite action, and, conſequently, produce pain in the weakened part. Thus, the percuſſion of the air ſtimulates and cauſes pain; hence, rain or ſnow, drifted in the face, produces much more pain than when it flies more gently, although, in both caſes, the temperature be the ſame.

THAT cold produces redneſs, is no proof that it is a ſtimulant; for this redneſs is, at firſt, produced by a diminiſhed circulation, the blood remaining longer in the veins; and, therefore, the part becomes of a purple hue, which is very different from the bright red, produced by

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* See Prelim. Diſſert. p. 267.

the direct action of a powerful ſtimulant.

It may alſo be ſaid, that cold ſtops bleeding, and that alcohol does the ſame, therefore cold is a ſtimulant; but it is to be remembered, that there exiſts this material difference, that cold ſtops active and alcohol paſſive hemorrhage. Cold has likewiſe been ſuppoſed to be a ſtimulant, from the invigorating effects of the cold bath; but, in order that cold may invigorate, it is neceſſary that it be applied for only a ſhort time, and be frequently repeated; it thus, by diminiſhing the action of the ſurface, increaſes that of the internal parts, and thus ſtrengthens. That cold does not inflame, by its ſtimulant power, will be immediately ſeen.

Those who maintain cold to be a ſe-

dative, have been under the neceſſity of maintaining, that it never inflamed unleſs ſome direct ſtimulant was afterwards applied; or that, by relaxing the veſſels, it made them admit more blood, and thus produced a kind of inflammation: But it is to be remembered, that in the living ſyſtem, blood does neither accumulate in a part, nor is its quantity diminiſhed by any general mechanical cauſe operating on other parts, or by any affection of the propelling cauſe, but that the ſtate of the veſſels, with regard to blood, depends upon their own condition. Weakneſs, in any part of the arterial ſyſtem, ought to diminiſh the quantity of blood in that part: Weakneſs, in the veinous ſyſtem, will indeed produce accumulation of blood; but this cannot produce inflammation. Cold, then, cannot act by its relaxing power. Experience likewiſe proves, that cold may induce inflamma-

tion, without requiring, for this purpoſe, the ſubſequent application of heat, or any other artificial ſtimulus.

Cold may operate on a part, and deſtroy it in three different ways. Firſt, it may be applied in ſuch a degree, and for ſuch a length of time, as to deſtroy the vitality of the part directly; in which caſe, ſloughs are formed. Second, it may be applied in a leſs degree, or for a ſhorter time; and afterwards a ſtimulant, ſuch as heat, may be applied, which will excite inflammation. The production of inflammation, by any agent, depends, in a great degree, upon the ſuddenneſs of the operation of the agent which excites it; for a quantity of ſtimulus, which, if ſuddenly applied, will produce inflammation, may be applied ſlowly with impunity. From which it will follow, that any given ſtimulant muſt more eaſily pro-

duce inflammation, in a part which has a low action, than in one having a vigorous action, there being a greater disproportion in the one caſe than in the other, betwixt the action induced by the agent and the previous action of the part. Hence, very ſlight ſtimuli will induce inflammation, in parts which have been weakened by cold. Third, it has been already mentioned, that a part ſympathiſes very much with thoſe which are contiguous to it. If a part be weakened, by having its action reduced, and if then the debilitating cauſe be removed, the action of the part will be increaſed, or excited, by its ſympathy with the neighbouring acting parts: But, as the action ought to be very little, the power being ſmall, it will follow, that diſeaſe, or inflammation, muſt ariſe from this cauſe, the action being increaſed beyond the power. We ought, therefore, in this

caſe, to diminiſh the action of the neighbouring parts, in order to prevent their extending their action to a part which is not able to bear it without becoming diſeaſed.

These remarks may ſuffice, with regard to the cauſes of inflammation which belong to the firſt claſs. I come now to conſider thoſe of the ſecond kind, or thoſe which operate, not upon the part to which they are applied, but upon diſtant parts, the chief of which cauſes is cold.

Cold, applied to the ſurface of the body, often inflames the internal parts. This has been often obſerved, and various explanations of it have been attempted; whilſt others have denied the exiſtence of the fact.

Dr. Brown ſuppoſed, that cold, at no time, produced inflammation of internal parts, unleſs it were applied to thoſe parts, and had heat applied after it; or, in other words, that cold acted always in one way, and never on any part to which it was not directly applied. He, therefore, claſſed the lungs amongſt the external parts, in order to account for peripneumony being produced by cold. He did not remember, however, that the pain and cough ſometimes make their appearance, whilſt the patient is ſtill expoſed to the cold, and before heat has been allowed to operate. He likewiſe forgot, that the temperature of the lungs is not affected by the temperature of the ſurrounding air, being neither warmed by warm air, nor cooled by cold air. The lungs are to be conſidered as the centre of the circulation, with regard to animal heat, the

heart being only a muſcle ſubſervient to them. But, granting that the lungs could be warmed or cooled, it is to be remembered, that a perſon riding in a cold night, will often have a ſore throat, or pain in his breaſt produced, (if the integuments covering theſe parts have been expoſed), before he alight, and, conſequently, before he could be expoſed to heat. If this take place in one inſtance, the theory muſt be falſe.

Dr. Cullen ſuppoſes, that cold inflames diſtant parts, by affecting the courſe of the fluids. When applied to the ſurface, it inflames the lungs, in his opinion, by obſtructing the perſpiration, and thus determining to the lungs. Cold is likewiſe applied, he ſuppoſes, to the lungs themſelves, at the ſame time *.

* Cullen's Firſt Lines, &c. Vol. I. par. 345.

Now, were this the cafe, the lungs ought not to be affected; for if cold were capable of acting on the lungs, it fhould obftruct the exhalation from them, as well as the perfpiration from the fkin; therefore, fome intermediate point, and not the lungs, would be injured.

The fame idea, although with fome modification, is adopted by Mr. Abernethy *, who fuppofes, that air is thrown out from the blood, along with the matter of perfpiration; and, therefore, that when the perfpiration is diminifhed, the determination of fluids to the lungs is particularly to be expected; becaufe, as the air which went off with the perfpiration is now retained, it goes to the only other place where it can get out, namely, the lungs, " where the fecretion is fimilar to

* Abernethy's Effays, p. 150.

"the one which has been ſuppreſſed;" by which ſuppreſſion the blood has "become ſurcharged with air, to which "the lungs only can afford an outlet."—"Thus, an accumulation of fluids, in "the pulmonary veſſels, will enſue."

These explanations of the action of cold, evidently overlook the action of the nerves, and the true hiſtory of diſeaſes; for no "increaſed determination of fluids" can take place, without increaſed nervous action. The ſympathies of fluids and veſſels, were once, indeed, favourite doctrines in the ſchools; and the trifling and uncertain anaſtomoſis of arteries or veins were anxiouſly looked for. But the fluids muſt now be conſidered as ſubordinate agents, and the changes and diſeaſes of the living ſyſtem traced to a higher ſource than hydraulic principles.

Seeing, then, that none of these opinions give a satisfactory explanation of the manner in which cold, when applied to the surface, inflames the internal parts, we must have recourse to another principle, or to the sympathy of equilibrium, by which, I apprehend, the fact may be sufficiently explained.

Cold, applied, in a moderate degree, to the whole surface, diminishes, for a time, the action of the skin, but raises that of the internal parts, and thus produces strength, if the application be frequently repeated; these parts being the most essential to the animal, and those on which its health and vigour chiefly depend.

This effect of cold, in raising or exciting the action of the internal parts, when applied to the surface, is also seen in the benefit which is derived from

dashing cold water on the thighs and legs, in cases of costiveness or suppression of urine, depending on torpor of the intestines or bladder. Upon the same principle, we may account for the occasional bad effects of the cold bath, when applied partially; for, in this case, the parts which are out of the water, may have their action morbidly increased, by the diminution of action in those parts which were immersed. Hence, the popular opinion, that if bathers do not plunge the head under the water, they will have head-ache produced, is not totally without foundation.

If the cold be applied to the surface for a considerable time, or to such a degree as to reduce the temperature of the skin considerably below that which obtained before the application, inflammation is very frequently produced, in some

internal part, owing to the morbid increafe of action which is thus produced in it. What part fhall fuffer thus, will, in a great meafure, depend on the portion of the furface which is expofed, each part of the fkin fympathifing chiefly with the organs immediately under it. Cold and damp, applied to the feet, are very apt to produce inflammation of the throat.

Cold will moft readily produce inflammation, when the furface has had its action previoufly much increafed by heat. When the fkin of the throat or breaft is very warm, and is fuddenly expofed to cold, cynanche or pneumonia is, in nine cafes out of ten, produced.

From thefe remarks we may underftand, firft, how cold applied to the furface, in a certain degree, and for a certain

time, inflames the internal parts; ſecond, how, when it is applied to a greater degree, and continued for a longer time, it inflames the part itſelf on which it directly acts.

It is obſervable, that ſome people are more ſubject to inflammation than others; and, by examination, we ſhall find, that theſe are the moſt vigorous and plethoric. This condition, from its propenſity to inflammation, has been named the phlogiſtic diatheſis. This ſtate is induced by the uſe of ſtimulating and highly nouriſhing diet, invigorating exerciſe, and the application of cold in ſuch a way as to prove tonic.

Inflammation is readily induced in ſuch people, and is worſe borne by them, becauſe, as Mr. Hunter has obſerved, their action is already as high as it can

poſſibly be, without cauſing diſeaſe. A very trifling increaſe, then, which will be eaſily induced, muſt be productive of inflammation. Hence, operations are borne worſe by healthy people than by thoſe who have been ailing for ſome time. There is, however, another cauſe which co-operates with this, and renders operations ſafer in thoſe who have had local diſeaſes of long continuance, than in thoſe who have met with ſudden accidents, namely, that the conſtitution has been long accuſtomed to diſeaſed or inflammatory action, and, therefore, is better able to endure the action which is induced by the operation; for morbid actions, which are ſuddenly excited in a healthy ſyſtem, are more dangerous than thoſe which come on more ſlowly. Even if the previous action had not been inflammatory, it was of a morbid nature, and, therefore, ſhould make the action

induced by the operation lefs dangerous; becaufe we have ftill only exchanged one difeafed action for another, and not excited it in a fyftem formerly healthy.

Of the Proximate Caufe of Inflammation.

CONCERNING the proximate caufe of inflammation, a very great diverfity of opinion has prevailed; but ftill almoft every theory has agreed in admitting the agency of an obftructing caufe.

FOR feveral centuries, the opinions which were held on this fubject were very much the fame, and received no material change until the difcovery of the immortal Harvey.

WHILST the circulation of the blood was unknown, and whilft the hypotheti-

cal notions of the power of the liver, in preparing and ſending forth this fluid, continued to prevail, it is not aſtoniſhing that the theories of phyſic ſhould be exceedingly imperfect. So fully perſuaded were phyſicians of the exiſtence and agency of different humours and ſpirits, and ſo little did they know of the regular and conſtant motion of the blood, that they believed in the poſſibility of depoſitions and congeſtions of the blood, the bile, or the lymph; and acknowledged theſe as the cauſe of inflammation. Their anatomiſts taught them, and their profeſſors of phyſic ſupported the opinion, that the liver was the centre of the vaſcular ſyſtem, from which the blood went forth by day to the extremities, and returned again by night. If, then, any peccant matter irritated the liver, then the blood was ſent out more forcibly; and if, at the ſame time, any part of the body were

weakened, or otherwife difpofed to receive a greater quantity of fluid than the reft, then a fwelling was produced by the flow of the humours to this place. *Fluxions*, or flows of humour to a place, might happen either by weaknefs of the part, which allowed the humours to enter more abundantly, or by the place attracting the humours, in confequence of the application of heat, or other agents. When the fluxion was produced, by fome irritating caufe applied to the fource of the blood or humours, and a weaknefs of the part affected, then the part was faid to be paffive; but when the fluxion arofe from fome caufe, acting directly on the part, and making it attract the humours, then it was faid to be active. The teachers of medicine, then, had two great heads for commenting on; firft, the ftate of the part tranfmitting; and, fecond, the condition of the part receiving. The pe-

culiar nature of theſe tumors, depended upon the humour which was ſent in the greateſt abundance; blood, for inſtance, produced the true phlegmon; bile produced eryſipelas, &c.

It was likewiſe believed, that, at other times, the part might ſomehow allow the blood or humours to ſtagnate ſlowly in it, from a want of expulſive power; or might detain the fluid, "quæ in loco "affecto gignitur." The tumor thus produced, was called a *congeſtion*, to diſtinguiſh it from the one which aroſe from the ſudden flow of humours from a diſtant part, and which was called a *fluxion* or *defluxion*. The firſt was formed gradually, without much pain, or the feeling of pulſation, and run its courſe ſlowly; the ſecond appeared ſuddenly, was very painful, had a pul-

ſatory feeling, and run its courſe rapidly.

As the blood was ſuppoſed to poſſeſs very little motion, and to have its courſe eaſily diverted or changed, by very trifling cauſes, it became an eſtabliſhed rule, that, in fluxions, we ſhould endeavour to alter the direction, or "determination," of this fluid. In recent inflammation, they laid it down as a fixed principle, to bleed from ſome part which was diſtant from the ſeat of the diſeaſe, by which they imagined, that the current was changed, and a *revulſion* made. If the inflammation was above the liver, which, they ſaid, was the centre of the body, conſidered medically, they took blood from ſome part below it; when one ſide was affected, then they bled from the other. They likewiſe made a catalogue of the different veins, which

purged the different parts, or detracted from them; and this aſſiſted them in their practice. The cephalic vein evacuated the head; the baſilic, the parts farther down; whilſt the median detracted from both parts: The left arm evacuated the ſpleen, and the right one the liver *.

A REVULSION was alſo effected, by raiſing a tumor in ſome other part, by means of ligatures, cupping glaſſes, &c.; or, by giving nature an opportunity of diſcharging the humours from diſtant parts, by applying leeches or bliſters to

* The natives of Thibet and Boutan ſtill retain ſimilar ſentiments: They bleed in the neck, when they wiſh to cure pains in the head; the cephalic vein is opened, when the arm or ſhoulder is injured; the median detracts from the breaſt or ſide; the baſilic from the belly; and the veins at the ankles from the two inferior extremities. Vide Phil. Tranſ. Vol. LXXIX.

these: Hence, finapifms were applied to the feet, in difeafes of the fuperior parts.

If it were not convenient, or if it were not judged proper, to make a complete revulfion, then blood was drawn from the neighbourhood of the parts *, and this was called *derivation*, which differed from revulfion only " in the meafure of the diftance to which the humour was drawn." As this, however, was fuppofed rather to draw more fluid to the part, than to draw from it, moft people confidered it as dangerous to ufe derivation in the beginning of the difeafe.

At the fame time that bleeding was ufed copioufly, they alfo applied repel-

* In inflammation of the throat, for inftance, blood was taken from the lingual veins.

lents to the part, in order to co-operate with the other remedies. Thefe confifted of aftringents, mixed with an innumerable quantity of inert drugs. If, on the contrary, it was thought improper to repel the matter, then the tumor was to be refolved by " difcuffion," or a " breathing out of the humour, by in- " infenfible tranfpiration ;" and this was effected by applications, which were faid to be " hot, fubtle, and powerfully pe- " netrating ; fuch as, althea, camomile, " nitre, alkali," &c. This method, however, was generally reprobated, in the commencement of inflammation. When neither of thefe plans would fucceed, then the matter was to be concocted, the tumor fuppurated, mundified, deterged, incarned, and finally cicatrized.

Bleeding was directed to be lefs frequent in the congeftion than in the

fluxion; but then the purges were to be ſtronger, and given with a more liberal hand *. Alongſt with the exhibition of purgatives, the hot remedies, called diſcutients, were to be applied to the part itſelf; ſuch as, thyme, galbanum, ſal ammoniac, &c.

At laſt, the doctrine of fluxion began to loſe ground, and the phyſicians ſlowly to perceive, that their boaſted theories of derivation and revulſion were abſolutely incompatible with the true hiſtory of the circulation of the blood. The cauſe of inflammation was now ſought for, more univerſally, in the part itſelf, and ob-

* In fluxions, purging was conſidered as a dubious remedy, at leaſt, where the liver was in fault; becauſe it was thought to draw all the foul and noxious matters to that quarter.

ſtruction declared, more decidedly, to be the parent of diſeaſe.

It was the opinion of Boerrhave *, that inflammation was cauſed by an obſtruction to the free circulation of the blood, in the minute veſſels; and this obſtruction, he ſuppoſed, might be cauſed by heat, diarrhœa, too copious flow of urine, and ſweat, or whatever could diſſipate the thinner parts of the blood, and produce a thickneſs or viſcidity of that fluid. Where this lentor did not exiſt before the production of inflammation, he imagined, that the larger globules of the blood got into the ſmall veſſels, and thus plugged them up. When, for inſtance, the perſpiration was ſtopped, the fluid being retained, dilated the veſſels, and allowed ſome of theſe miſchievous

* Aph. 375. et ſeq.

globules to enter, and produce a more permanent obſtruction. This circumſtance was termed an error loci, and was one of the chief cauſes aſſigned for inflammation. But whether the obſtruction aroſe from the viſcidity of the blood, or, independently of it, from an error loci, the ſame effect was ſuppoſed to be produced, namely, a reſiſtance to the circulation, which, of courſe, increaſed it in the other veſſels, proved an irritation to the heart, and increaſed the force or attrition of the blood, in that part of the veſſel which was behind the obſtruction; this, again, cauſed heat and pain, whilſt the accumulation of the blood produced redneſs; which three ſymptoms are the eſſence of the diſeaſe. But, beſides this obſtruction, he alſo brought into account an acrimonious ſtate of the fluids; and, when this occurred, reſolution was out of the queſ-

tion; nay, if the acrimony were great, gangrene was almoſt unavoidable*.

The viſcidity of the blood cannot be admitted as the proximate cauſe of inflammation; becauſe we have no proof that this ſtate ever exiſts; or, granting that it did, it would not explain the phenomena. In inflammation, the blood, ſo far from being deranged in the proportion of its component parts, or from one portion having a greater quantity of coagulable lymph (which alone could make it thicker) than another, ſeems to have its principles more intimately united; for it requires a longer time to ſeparate them by coagulation; and, therefore, no variation can take place, in any particular part of the body. If, then, a viſcidity takes place, it muſt exiſt equally

* Aph. 388.

in every portion of the blood ; and, if ſo, it muſt affect every part of the body alike ; and, therefore, cannot be ſuppoſed to produce only a local diſeaſe. But, granting it to be *poſſible* for viſcidity to induce inflammation, it remains to be demonſtrated, how this lentor is occaſioned, by cauſes which bring on inflammation ſuddenly, without affording time for changes of the fluids to take place. It alſo remains to be proved by experiments, that ſuch a thickened ſtate of the blood ever does exiſt, either in inflammation, or in any other diſeaſe.

WITH regard to the doctrine of error loci, or of red globules going into veſſels which did not formerly tranſmit them, the fact muſt be admitted, at the ſame time that the concluſion is denied. When the eye becomes inflamed, the tunica conjunctiva is ſeen, with its veſſels full of

red blood, which, in health, is not the cafe; but this rednefs never appears until the inflammation has commenced; it is therefore to be confidered as an effect, and not as a caufe. Nor does this error loci occafion any obftruction in thefe veffels; for, if they be divided, the blood flows freely, which fhows, that they are large enough to allow of an eafy circulation, a circumftance which is altogether incompatible with the notion of obftruction: For, were this obftruction to take place, the flow of blood muft be checked; it muft either move much more flowly, and, therefore, ftimulate lefs; or, it muft take another courfe; for it is well known, that, whenever a veffel is obftructed by preffure, by adhefion, or by a globule plugging it up, that lefs blood muft go that way, and more by another courfe; the confequence of which is, that the part will rather be weakened than inflamed.

As for the ſuppoſition of the co-operation of an acrimony of the fluids, it may be ſufficient to obſerve, that the proportion of the ſaline matter of the blood has never been proved to be greater in this than in any other ſtate of the body, and that the very idea of cacochymy is diametrically oppoſite to the laws of the living ſyſtem. But enough has been formerly ſaid, in the preliminary diſſertation, concerning the humoural pathology; and more will be afterwards adduced. The ſubject may, therefore, for the preſent, be diſmiſſed.

Professor Vacca * was likewiſe of opinion, that an obſtruction to the motion of the blood was the cauſe of inflammation; but this he attributed, not

* Vacca de Inflam. Morb. &c.

to lentor, or error loci, but to a debility of the inflamed part, which prevented it from propelling the blood as formerly, and produced an accumulation of it in the weakened veſſels, the conſequence of which, in his opinion, was a ſpecies of combuſtion, or real inflammation. He begins by obſerving, that there are four principal fluids in the body; the blood, the lymph or ſerum, the fat, and the nervous fluid. The lymph, being watery, cannot be inflamed or burnt; the blood is ſlightly inflammable; the fat is altogether ſo; but the nervous fluid, from its volatility, cannot bear enough of heat to inflame it. It is alſo laid down as a principle, that no inflammation can take place without the aid and operation of atmoſpheric air, which both draws inflammable matter to the part, and inflames it. Without fatty, or phlogiſtic matter, then, and air, no inflammation can take place,

This inflammation is begun by the accumulation of blood, which is to be considered as a heated, or ignited body. The accumulation and "semistagnation" of the blood, uniformly depends upon a weakness of the part, either real or absolute; real, when its power is positively diminished; relative, when it is not diminished, but the strength of the rest of the system preternaturally increased above it *.

In consequence of this weakness, the blood not only moves more slowly, but more also flows in, which produces a

* "Inflammatio cujusvis partis humani corporis, numquam sit, nisi in ipsa parte sanguis coacervetur, et fere quiescat."—"Coacervatio et semistagnatio sanguinis, vel alius humoris corporis humani, in quacumque ipsius corporis parte minime contingere potest, sine ipsius partis absoluta, vel relativa debilitate." Vacca, p. 18.

ſwelling of the part. This is farther increaſed, by the extrication of air from the ſtagnant matter, in conſequence of the heat, by which the part is diſtended, and ſtill more humour and phlogiſtic matter is allowed to flow in.

Upon the humoural part of this theory, I deem it to be unneceſſary to make any obſervation ; and, upon the poſition, that debility of the inflamed part is the cauſe of inflammation, I think it ſufficient to obſerve, firſt, that many of the exciting cauſes evidently have no tendency to weaken, when they induce inflammation: Heat, for inſtance, frequently inflames before it can poſſibly be ſuppoſed to have produced any weakneſs. Second, all the ſymptoms of inflammation evince an increaſed action. Third, bleeding, and other cauſes, which diminiſh action, cure inflammation.

Dr. Cullen confiders the proximate caufe of inflammation to be "a fpafm of "the extreme arteries, fupporting an in-"creafed action in the courfe of them." This theory, therefore, differs from that of Dr. Boerrhave only in the caufe which is affigned for the obftruction. A detection of the fallacy of the one fuppofition will, therefore, be fufficient to difprove both. But, as Dr. Cullen was a man who formed no opinion without a plaufible reafon, it will be proper to attend more minutely to his doctrine; and this is very plainly laid down in the two hundred and forty-fourth and two hundred and forty-fifth paragraphs of his Outlines. "Some caufes of inequality (fays "he), in the diftribution of the blood, "may throw an unufual quantity of it "upon particular veffels, to which it "muft neceffarily prove a ftimulus. But, "farther, it is probable, that, to relieve

" the congeſtion, the vis medicatrix na-
" turæ increaſes ſtill more the action of
" theſe veſſels; and which, as in all o-
" ther febrile diſeaſes, it affects, by the
" formation of a ſpaſm on their extremi-
" ties."—" A ſpaſm of the extreme arte-
" ries, ſupporting an increaſed action in
" the courſe of them, may, therefore, be
" conſidered as the proximate cauſe of
" inflammation; at leaſt, in all caſes not
" ariſing from direct ſtimuli applied;
" and, even in this caſe, the ſtimuli may
" be ſuppoſed to produce a ſpaſm of the
" extreme veſſels."

These paragraphs contain three poſitions; firſt, that there is, originally, a congeſtion, or accumulation of blood; ſecondly, that this is removed by the formation of a ſpaſm; thirdly, that this ſpaſm is the work of the vis medicatrix naturæ.

Upon the firſt of theſe poſitions, it will be ſufficient to remark, that this accumulation of blood is conſidered as the cauſe of inflammation, and not as an effect; whereas, it is evident, that it exiſts only as a ſymptom. When, for inſtance, we apply heat, a bliſter, or any acrid ſubſtance, to the ſurface, the part is ſtimulated, that is to ſay, the action of its nerves is increaſed, which muſt, conſequently, increaſe the action of its veſſels, and, of neceſſity, the quantity of blood. But, moſt aſſuredly, this increaſed quantity of blood is not the primary cauſe of inflammation; it is the conſequence of an increaſed action of the blood-veſſels, which, again, is merely an effect of the increaſed nervous action. The firſt poſition is, therefore, erroneous; for this accumulation of blood is not an original, or primary cauſe, but depends upon a diſeaſe already induced. At the ſame

time, it is certain, that this increaſed quantity of a ſtimulus muſt react on the nerve, and augment ſtill farther its action, and, therefore, increaſe or keep up the inflammation already induced.

The ſecond poſition takes for granted that the firſt is eſtabliſhed, and that the congeſtion is to be removed by the formation of a ſpaſm; or, in other words, that the accumulated quantity of blood is to be propelled, or diſmiſſed, by rendering the extremity of the paſſage narrower, and the circulation more difficult, which is a contradiction in terms. The obvious effect of this conſtriction muſt be, to deſtroy the free communication of the artery with its returning vein. The blood already in the part muſt ſtagnate, and become veinous, or it muſt eſcape by a retrograde motion, the exiſtence of which, to any extent, is not proved.

Whenever a veſſel is conſtricted, either by a ligature, or any other cauſe, we uniformly find, that the courſe of the circulation is altered, more being ſent through the branches of the artery coming off above the obſtruction; therefore, the part directly ſupplied by the obliterated or conſtricted artery muſt, for a time, be weakened. It may be ſaid, that though the part ſupplied by the obſtructed veſſel may be debilitated, yet thoſe parts which, in conſequence of this obſtruction, muſt receive more blood, will be inflamed: But we daily find, that, even tying a large veſſel, does not of itſelf produce this diſeaſe; how much leſs, then, will conſtricting the extremities of a few twigs be capable of affecting it? The uniform effect of obſtruction muſt be, to retard the circulation, and produce torpor, circumſtances altogether incompatible with the exiſtence of inflammation, which implies more power-

ful contractions, and a more complete and forcible circulation. Phlegmon is alſo attended with an effuſion into the cellular ſubſtance from the extremities of the arteries, a circumſtance not eaſily explained upon the principle of obſtructed circulation.

The third poſition is, that the formation of the ſpaſm is the work of the vis medicatrix naturæ; but, having denied the truth of the former poſition, it follows, that the preſent ſuppoſition requires no anſwer; becauſe it is unneceſſary to ſhow the abſence, or inſufficiency of a cauſe, if the exiſtence of the effect be diſproved. Still it may not be improper to remark, that the ſpaſm induced, or the agency of the vis medicatrix, is conſidered as producing the moſt ſerious part of the diſeaſe. It is not the congeſtion of blood which is held out as the proximate cauſe, but the

attempt which the healing, or preſerving power of nature makes to get quit of it. The blood is here conſidered as an exciting cauſe, but is by no means underſtood to operate directly; on the contrary, it only gives notice to the preſerving power, which, in order to get rid of it, occaſions a ſpaſm, followed by diſeaſe. Nay, ſo far does Doctor Cullen carry his theory of ſpaſms, and preſerving powers of nature, that he imagines, that even ſtimulants, operating directly on a part, ſuch as cantharides, mezereon, or red precipitate, induce inflammation, in the ſame round-about way. But, by a very little attention, we ſhall find, that all theſe agents operate primarily on the nerves, increaſing their action, and changing it, and, of conſequence, the action of the veſſels ſupplied by them. This action, however, is very different indeed from ſpaſm or obſtruction.

The celebrated John Brown taught a doctrine, which was new to the Edinburgh Profeſſors, and diametrically oppoſite to the theories which were maintained in their ſchools. Diſeaſes, according to his ſyſtem, were all divided into two claſſes, thoſe which conſiſted in a morbid degree of ſtrength, and thoſe produced by the varied degrees of weakneſs. This theory was, to appearance, ſimple; it was built entirely on the ſthenic and aſthenic diatheſis, and admitted of no intricate actions of the living ſyſtem. Little labour, then, was demanded of the ſtudent, and not much reflection of the practitioners. It was addreſſed, in a peculiar manner, to the indolent diſpoſitions of mankind, and, therefore, met with conſiderable ſucceſs, which perhaps was not a little increaſed by the plea of perſecution.

Inflammation was ſaid, by Dr. Brown, to depend either upon too much ſtrength, or too much weakneſs. In the firſt caſe, the veſſels contracted with great force, and puſhed on their contents with fury. In the ſecond, the veſſels were too weak to carry on the circulation properly, but relaxed freely, to allow as much blood to be puſhed into them, as the vis a tergo was able to do. This, however, is by much too mechanical an idea, and cannot be admitted, now that the reaſonings of the mathematical phyſicians have ſunk into oblivion. The whole ſeries of ſymptoms, together with the circumſtances which frequently attend the acceſſion of inflammation, as well as its ending in other actions, diſprove the ſuppoſition. If inflammation depended, in one caſe, upon too much contractile force of the veſſels, and, in another, upon their relaxation, then, in

order to give conſiſtency to the doctrine, it ought to be admitted, that ſecretions were formed by filtration; and that theſe ſtates of the veſſels, after a certain duration, came to ſtrain through pus. Mere increaſe of ſtrength, excitement, or contractile power, without a change of action, never can produce the phenomena of inflammation, nor account for adheſion, ſuppuration, or ulceration. Partial debility of the veſſels cannot, on the other hand, produce the ſecond ſpecies of inflammation; becauſe this debility ſhould, at the very utmoſt, produce only a ſlower circulation, and not an inflammatory action: Neither ought it to be the cauſe of ſwelling and turgidity of the arteries, by allowing more than the due quantity of blood to be forced into them; for the quantity of blood in a veſſel, does not depend upon the proportion betwixt its contractile power, and

the propelling power of the reſt of the ſyſtem, but upon its own action entirely; otherwiſe, we ſhould find paralytic limbs always turgid with blood. Farther, the Brownonian theory will not explain the phenomena of inflammation in weakened parts; for here there is a great action, with little power; and hence the part is almoſt immediately killed. The progreſs of this is ſtopped by bark and opium, with proper local applications. From the treatment, then, the Brownonian would ſay, that the inflammation depended upon weakneſs. But will ſimple relaxation explain why death ſhould ſo rapidly take place?

According to Mr. Hunter, "Inflammation is to be conſidered only "as a diſturbed ſtate of parts, which "requires a new, but ſalutary mode of "action, to reſtore them to that ſtate,

" wherein a natural mode of action a-
" lone is necessary. From such a view
" of the subject, therefore, inflammation,
" in itself, is not to be considered as a
" disease, but as a salutary operation,
" consequent either to some violence, or
" some disease *."—" The act of inflam-
" mation is to be considered, as an in-
" creased action of the vessels †," which
at first consists simply in " an increase or
" distension beyond their natural size ‡."
This increase seems to depend upon a
diminution of the muscular power of the
vessels, at the same time that the " elastic
" power of the artery must be dilated in the
" same proportion §." This is, therefore,
" something more than simply a common
" relaxation; we must suppose it an action

* Hunter on Inflammation, p. 249.

† P. 278. ‡ P. 279. § P. 282.

" in the parts, to produce an increafe of
" fize, to anfwer particular purpofes;
" and this I fhould call an action of di-
" latation." The whole is to be confider-
ed, " as a neceffary operation of nature*."
Owing to this dilatation, there is a great-
er quantity of blood circulating in the
part, " which is according to the com-
" mon rules of the animal economy; for,
" whenever a part has more to do, than
" fimply to fupport itfelf, the blood is
" there collected in larger quantity†." The
fwelling is produced by an extravafation
of coagulable lymph, with fome ferum;
but this lymph differs from common
lymph, in confequence of paffing through
inflamed veffels‡. It is this lymph which
becomes the uniting medium of inflamed
parts; veffels fhoot into it; and it has
even the power of becoming vafcular it-

* P. 282. † P. 280. ‡ P. 311.

ſelf*. The pain proceeds from ſpaſm †: The redneſs is produced, either by the arteries being more dilated than the veins, or becauſe the blood is not changed in the veins ‡. When a part cannot be reſtored to health, after injury, by inflammation alone, or by adheſion, then ſuppuration, as a preparatory ſtep to the formation of granulations, and the conſequent reſtoration of the part, takes place §. The veſſels are nearly in the ſame ſtate as in inflammation; but they are more quieſcent, and have acquired a new mode of action ‖.

INFLAMMATION, according to this, as well ſome other doctrines, is to be conſidered, not as a diſeaſe, but as a ſalutary

* P. 309. † P. 386. ‡ P. 381.

§ P. 371. ‖ P. 372.

operation of ſome wiſe and provident power, performed in order to rid the ſyſtem of ſome impending evil, or to renew a ſtructure, which could not otherwiſe be reſtored. But I hold it to be an eſtabliſhed point, that there is no ſuppoſition more directly contrary to true philoſophy, or to the principles which reaſon teaches, than the opinion, that certain events take place, merely becauſe theſe events are uſeful; as, for inſtance, the coagulation of the blood in mortification *; whether we refer theſe events to the agency of ſome peculiar power called nature, or to the more extenſive operation of ſome general principle.

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* "For this purpoſe (coagulation), it (blood) requires reſt, either by extravaſation, or being retained in "the veſſels, till the utility of circulating is loſt, or till it "can anſwer ſome good purpoſe by its coagulation, as in "mortification." *Hunter on the Blood, &c.* p. 86.

INFLAMMATION is, in many caſes, ſo far from being a " ſalutary mode of ac- " tion," that, in a great majority of in- ſtances, it is a moſt dangerous and a moſt troubleſome diſeaſe ; and I ſhall preſent- ly endeavour to ſhow, that it is not through the interference of this action, that divided parts unite; but that, on the contrary, whenever the action be- comes inflammatory, that then no union and no reſtoration take place, but the ſides remain ſeparate, until the diſeaſe ſubſide.

INFLAMMATION is conſidered as " an " increaſed action of the veſſels," which chiefly conſiſts in a greater degree of di- latation, the power of muſcular contrac- tion ſeeming to give way. This allows more blood to enter; which greater quantity of blood is not conſidered as a ſymptom or part of the diſeaſe, but as

one of the contrivances of nature, the part having more to do than ſimply to ſupport itſelf.

How far the loſs or diminution of muſcular power will account for this dilatation, will afterwards be examined. Here I ſhall only obſerve, that the doctrine of the ſimple increaſe of action, (circulating action), in a veſſel, or ſimple dilatation, never can explain the production of inflammation, which is to be conſidered as a ſtate which is new and diſeaſed, and totally different, both in its nature and conſequences, from the condition which ſubſiſts in health. The other parts of the theory will come afterwards to be conſidered.

According to Dr. Darwin, when any part is excited " into ſuch violent motion, " that a quantity of pleaſurable or painful

"ſenſation is produced, it frequently "happens, but not always, that new "motions of the affected organ are ge- "nerated, in conſequence of the pain or "pleaſure, which are termed inflamma- "tion. Theſe new motions are of a "peculiar kind, tending to diſtend the "old, and to produce new fibres, and "thence to elongate the ſtraight muſcles, "which ſerve loco-motion, and to form "new veſſels, at the extremities or ſides "of the vaſcular muſcles *." Upon this theory I ſhall only make three obſervations: Firſt, the effect of inflammation, or ſenſation, is conſidered as its cauſe: Second, we very frequently have highly pleaſurable ſenſations, or great pain, excited in a part, without any production of inflammation; therefore, if the ſuppoſed cauſes of inflammation have exiſt-

* Zoonomia, Vol. I. p. 395. 396.

ed, and no circumſtances have occurred capable of counteracting their operation, it will follow, that theſe cauſes are not real, but imaginary: Third, the motions which are ſuppoſed to take place, are not ſufficient to explain the phenomena of the diſeaſe.

FROM an attentive examination of the operation of the exciting cauſes of inflammation, and from a view of its different ſymptoms, we cannot admit the proximate cauſe to conſiſt in viſcidity, or error loci of the blood, or ſpaſm, or ſimple increaſe of ſthenic or aſthenic diatheſis, or actions of dilatation, or increaſed ſenſation, but muſt, upon the principles already laid down, conſider it as a new and diſtinct action of the living ſyſtem. When this action is uncombined with any other morbid condition, the diſeaſe is ſimple inflammation; but when to this

another action is united, or when the inflammatory action is modified, the disease is no longer simple, but specific inflammation.

In examining new actions, we find it to be of use to compare them with those which they resemble most, and with which we are better acquainted. It has been already mentioned, that whatever tended greatly or suddenly to increase the natural action of a part, changed it, and produced inflammation. This we learn, from examining the exciting causes of this disease; and, by analysis, we find some similarity betwixt this and the natural action.

The essential symptoms of inflammation, are, redness, swelling, heat, and pain, which, in some instances, are preceded, and, in others, followed, by a

general diſeaſe. Theſe ſymptoms, when taken together, differ very materially from the natural ſtate and condition of the part; and, therefore, although they may have been produced by cauſes which tend to increaſe the natural action, yet we muſt conſider this action as materially changed, in conſequence of the morbid increaſe.

ALTHOUGH this be the caſe, and although many new actions do not admit of analyſis, yet the different ſymptoms of inflammation may be explained, or the action analyſed; and this I ſhall proceed now to do.

Of the Ratio Symptomatum.

REDNESS.—The redneſs of the inflamed part, is evidently owing to the

presence of a greater quantity of blood than usual; and this augmentation seems to be produced, both by the vessels which formerly conveyed the blood being more distended, and also, by the enlargement of the small vessels, which formerly contained only lymph, but which now receive red blood. It is the enlargement of these small vessels, which have made some suppose, that new vessels were formed by inflammation; a supposition which is evidently contradicted, by observing, that heat, and many other causes of inflammation, operate so quickly, that no new vessel can have time to be formed; and yet the redness is as great, and the inflammation as perfect in a minute, as in an hour or a day, after their application. The formation of a perfect and regularly organised substance, by a strongly diseased action, is

likewiſe incompatible with the uſual laws of the animal economy.

THERE is, likewiſe, another cauſe, which will co-operate with this, in producing that bright redneſs which attends many inflammations, namely, that, owing to the diſeaſed action, the arterial blood is not ſo thoroughly converted into veinous, as in health *. Another conſequence of which, as has been formerly mentioned, is, that leſs life or energy is yielded to the part, and therefore it ſuffers more than it otherwiſe would do.

As the veſſels are ſuppoſed to act more powerfully in inflammation, it has been

* This fact has been mentioned by Mr. Hunter; but he accounts for it upon the principle of its motion being accelerated, which is certainly a miſtaken view of the ſubject. P. 281.

thought, that they ought to contract to a greater degree; and, therefore, ought rather to allow lefs blood than formerly to enter, than to become turgid. Some have, therefore, fuppofed, that inflammation was uniformly produced by weaknefs of the part; and this idea is, in one view, adopted by Mr. Hunter, who fuppofes, that the mufcular power of the veffels is diminifhed in inflammation, which, therefore, can be more fully dilated. But, certainly, the continuation of the circulation, implies a continuation of the powers which carry it on. Mr. Hunter even allows, that the blood circulates fafter than ufual, which cannot well happen, if the mufcular power gives way. The blood is carried from the heart along all the veffels, firft, by the percuffive force of the heart, and next, by the contractions of the arteries, which co-operate with the original pro-

jection. Without mufcular contraction in every part of the veffels, we muft either fuppofe the heart to poffefs a force beyond all belief, or we muft allow the circulation to proceed only a very little way; for the amplitude of a projected body is always as the fquare of the impetus. Were the arteries only elaftic, they could only react on the blood, and propel it onward, in a degree proportioned to the original action of the heart, and, at every inch, the velocity muft become lefs, becaufe the communicated force muft be diminifhing. Mr. Hunter, who allows both mufcularity and elafticity to the arteries, admits, that the elafticity diminifhes with the fize, whilft the mufcular power increafes as the other diminifhes. If, then, the mufcular coat of the extreme veffels be deftroyed or weakened, then the circulation muft be ftopped, and the part be-

come torpid, inſtead of inflamed, becauſe there is little or no elaſticity to aſſiſt the circulation. Mr. Hunter likewiſe ſuppoſes, that, in inflammation, "the elaſtic power muſt be dilated;" by which, I ſuppoſe, he means the elaſtic coat. This coat, granting it to exiſt in the minute veſſels, muſt then, by this dilatation or over-ſtretching, be deprived of its elaſtic properties, and, therefore, the circulating power of the artery be ſtill more deſtroyed.

Some, who have had recourſe to the ſuppoſition of weakneſs producing inflammation, have conjectured, that the power or force of the upper part of the artery was increaſed, in proportion to the weakneſs of the extremity; and, therefore, that, by the vis a tergo, the circulation was carried on, and the part likewiſe became more turgid. But this

goes upon the ſuppoſition, that the exciting cauſes of inflammation can always act more upon parts at a diſtance, than upon the inflamed part; and reduces the whole nearly to the old doctrine, of a part ſending and a part receiving.

It muſt then be evident, that the muſcular power of the artery continues ſtrong and vigorous, and that the contractions are more forcible. The dilatation of the artery is proportioned to the contraction; for, unleſs in ſpaſmodic diſeaſes, the two properties of a muſcle, contraction and dilatation, balance each other *.

* It may perhaps be ſaid, that as muſcles, when inflamed, become rigid, ſo the muſcular power of the arteries, in inflammation, ought to be diminiſhed. But it is to be remembered, that the ſtate of the veſſels, and the ſtate of the inflamed parts, are not exactly ſimilar, and that the ſame effects are not produced in each. This muſt be evi-

Swelling.—The ſwelling of an inflamed part may be aſcribed to two cauſes; firſt, to the increaſed quantity of blood in the veſſels; ſecond, to the depoſition of new matter. As the firſt of theſe has been already noticed, I ſhall only here attend to the ſecond.

In every part of the body, there are two ſets of veſſels, (though many, for particular purpoſes, have more): The one ſet ſecretes the matter which forms the parts, or depoſits new organic particles * as the old ones are abſorbed; the

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dent. In the ſame way, the ſtate of the veſſels in an ulcer, and the ſtate of the ulcer, or the condition of the veſſels in any gland, and the ſtate of the gland itſelf, are diſtinct in their effects and phenomena.

* By organic particles, I underſtand matter ſecreted or depoſited in an organiſed ſtate, ſo as to repair the waſte of the body. By the ſame term, the Compte de Buffon un-

other excretes a particular fluid into the interftices, betwixt the different organic particles, in order to preferve the neceffary degree of foftnefs and mobility *. Now, it muft be evident, that if the action of a part be changed, the functions of the part, and its fecretions, muft alfo be more or lefs affected.

In inflammation, the action is not only increafed, but changed; the fecretions, therefore, are alfo changed, and in part increafed.

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derftands molecules, which exift every where in the fame form, and do not receive their organifation at the part which they are to join.

* This fluid is even to be found betwixt the particles of bone; but it differs in them from the fluid which foftens mufcles, and this again from that which belongs to the brain, &c.

The interſtitial fluid (or the fluid which ſoftens the parts) is increaſed in quantity, but it is alſo different from what it was in health: It is leſs perfectly prepared, (if by perfection we mean the ſtate which was originally intended), and approaches nearer to the nature of the lymph or ſerum. All the ſecretions are formed from the blood; and, therefore, the leſs perfectly that they are formed, the nearer muſt they approach to the nature of the fluid from which they derive their origin.

The ſame cauſe which affects the production of the interſtitial fluid, muſt likewiſe, in a certain degree, affect the formation of the new or organic particles of the part. Theſe, in inflammation, will be depoſited, like the interſtitial fluid, in greater quantity, but they will likewiſe be leſs perfect; for both the per-

fection and the longevity of the particles depends upon the arteries performing their functions regularly and slowly.

The swelling, then, depends, first, upon the presence of a greater quantity of blood than usual; secondly, upon the increase and change of the interstitial fluid; and, thirdly, upon the deposition of more organic particles, in an imperfect state *. The second cause operates much more than the other two; for where there is little interstitial fluid, the swelling is less.

Mr. Hunter supposes, that the swelling is chiefly produced by the extravasation of coagulable lymph, which undergoes some changes, by passing through

* Owing to this cause, and to the greater thickness of the interstitial fluid, the part feels hard.

inflamed veſſels; and that this change "obliges it to coagulate" ſooner than it otherwiſe would do *. But this operation, as he himſelf acknowledges, ſhould rather retard the coagulation, than accelerate it.

PAIN.—In the preliminary diſſertation †, it was mentioned, that every new or imperfect action is productive of ſenſation in the mind; and it is upon this principle, that we are to account for the pain which attends inflammation. The more violent that the inflammatory action is, compared to the power of the part, or its previous ſtate of action, the more acute is the pain. When inflammation takes place in a part, whoſe ac-

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* Hunter on Inflammation, p. 311.

† Preliminary Diſſertation, p. 270.

tion naturally is ſmall, ſuch as cartilages and bones, or whoſe action, owing to the operation of other cauſes, ought to be very low, as, for inſtance, parts which have been weakened by cold, then the pain is very violent. The pain is likewiſe extremely acute, when parts are inflamed, which, in health, are very ſenſible *. Hence, inflammation of the inteſtines is attended with violent pain. In general, the pain, in ſimple inflammation, is greateſt during the diaſtole of the artery.

* That is to ſay, parts which have action eaſily excited in them. Some parts have their action increaſed ſlowly, and with difficulty, ſuch as tendons, bones, &c. which may be torn or broken without much pain, until the inflammatory action be ſlowly induced, and then the ſenſation is acute. If parts, whoſe action is naturally low, could have it eaſily and quickly increaſed, they would become diſeaſed from very trifling cauſes; becauſe theſe would readily induce an action much greater than the natural or previous action of the part.

Some aſcribed the pain to the mechanical cauſe of diſtenſion; but we muſt aſcribe it rather to the peculiar condition of the nerves, or their ſtate of acting; becauſe, otherwiſe, we ſhould find the pain to be in proportion to the degree of diſtenſion, which is not the caſe. Even the pulſatory feel, which attends inflammation, is not entirely dependent upon ſimple diſtenſion and contraction, but upon the peculiarity of the action; for, in ſome ſpecies of inflammation, that is to ſay, ſome modifications of the inflammatory action, this ſenſation is not produced.

Heat.—Some have explained the production of animal heat entirely on mechanical or chemical principles, and have too much overlooked the agency of the living principle: But, whatever means may be employed for this purpoſe, we

muſt acknowledge them to be entirely dependent on the actions of life. Common matter is capable of exiſting, without the aid of other matter; but animals and vegetables, which exhibit more varied phenomena, and perform more numerous actions, depend upon other ſubſtances for their growth and ſupport, and become afterwards, in their turn, ſubſervient to the neceſſities of other individuals: They receive their increaſe from the converſion of other matters into a part of themſelves, and have their life renewed, by changing the life of theſe matters into their own. Heat is likewiſe a principle, which is neceſſary to their exiſtence; and this alſo they derive from without, by proceſſes which depend upon the preſence of life. During reſpiration, the air, which is combined with the blood, and with ſome of the ſubſtances which it contains, gives out part of its

heat to the arterial blood, which unites with it, and from which it is again separated by the action of the living principle, in a quantity proportioned to the degree or extent of the action in general.

Those actions which, although different from the natural one, do not riſe in degree or violence beyond it, produce little or no increaſed quantity of heat. Thoſe actions which ſink below this medium, produce leſs heat, and thoſe which riſe beyond it, more, than is natural *. The production of heat is not exactly on the ſame footing with other ſecretions, which depend not ſo much on the degree, as on the peculiar nature of the ac-

* By low or violent action, I mean the ſtate of action, or its degree, conſidered relatively with regard to the power of the part, or to the proportion which ought to ſubſiſt betwixt action and energy.

tion; for this being a ſimple ſubſtance, cannot be changed by the change of action, but can only be affected, with regard to quantity, by the degree of action in the veſſels *.

The moſt current opinion, on this ſubject, is, that the production of animal heat, depends upon the difference in the capacity of arterial and veinous blood, for combining with heat: That, in the extreme veſſels, the arterial blood is combined with certain ſubſtances, in conſequence of which its capacity is diminiſhed, and heat is given out. On the other hand, when veinous blood is freed from theſe ſubſtances in the lungs, its capacity is increaſed, and the heat, which is given out by the decompoſition of the air

* It is chiefly at the ſurface, that the action produces a variation in the degree of actual heat.

which we inſpire, is abſorbed. But, granting all theſe facts to be proved, it ſtill muſt be admitted by every one who reaſons on the ſubject, that theſe changes cannot take place ſpontaneouſly, or of themſelves, but muſt be dependent upon the operations of the nervous energy. It will, then, be nearer the truth, if we conſider theſe changes rather as effects of the general operation which produces heat, than as direct cauſes upon which this production depends. The generation of heat in an animal, is truly a ſecretory proceſs, as much as the formation of bile or gaſtric juice, there being only this difference betwixt them, that, in the one caſe, a ſubſtance is ſeparated from the blood, which formerly exiſted perfectly in it, and which exiſts in perfection in every piece of matter, whilſt, in the other, the living power produces a new combination, and different arrange-

ment, of the principles of the blood, forming a ſubſtance which neither exiſted in it, nor elſewhere. Neither the one nor the other proceſs depend upon any active changes originating in the blood itſelf, nor upon chemical principles alone, but both are to be referred, for their production, to the intricate and inexplicable operation of the vital energy. The production of animal heat, then, does not depend directly upon the diminution of the capacity of veinous blood for combining with heat, or retaining it, more than the formation of bile depends upon the diminiſhed ability of the blood in the liver, to retain the principles of which it conſiſts.

The feeling of heat, then, in inflamed parts, will be great or little, according to the capability of the part for pro-

ducing heat, and its capability of receiving the ſenſation.

From theſe remarks, we may underſtand, how a greater quantity of heat is produced by an inflamed part, than that part, without acute inflammation, would produce *. We may alſo underſtand, how, in approaching mortification, the heat is little, becauſe the action is low, although it yet be ſufficient to kill the weakened part. We can alſo ſee, why

* It muſt be remembered, however, that, although the heat of a part be actually increaſed in inflammation, yet we are not to judge of the degree by the ſenſation which is produced; becauſe, owing to the increaſed ſenſibility of the part, a given ſtimulus will produce a greater effect than formerly. Hence, the contact of a foreign body gives pain, and the preſence of little more than the uſual quantity of heat will give the ſenſation of burning. We are to judge, then, of the real degree of heat, not by the ſenſation of the patient, but by the feelings which it produces in another perſon, when he touches the inflamed part, or by the application of the thermometer.

the inflammatio assuefacta, or what has been called passive inflammation, should produce much less heat, than the inflammatio valida; because the action rises little beyond the natural one, in degree, when compared to the power of the part, and has indeed become almost habitual to it.

THE inflammatory action naturally terminates by a secretion, the nature of which varies in different circumstances. Whenever this takes place, then the heat of the part falls, more or less, from its morbid degree; because, although the action be still unnatural or diseased, yet its violence is less.

EVEN the presence of any secretion, although not dependent on disease, will prevent the heat from being raised so high, by the inflammatory action, as it

otherwiſe would be *; one cauſe of which perhaps is, that the ſecretion carries off a quantity of heat; another is, thoſe parts which ſecrete moſt fluid, have leaſt capability of producing heat.

We uniformly find, that the inflammatory action of the parts which ſecrete leaſt, is attended with the production of moſt heat. The ſkin ſecretes leſs interſtitial fluid than other parts; and, although it ſometimes ſecretes perſpiration copiouſly, yet, in inflammation, this does not take place. It is, therefore, to be conſidered, with regard to inflammation, as one of the parts which ſecrete leaſt; and, on this account, the heat is much greater in inflammation of the ſkin, than of other parts: But the ſenſation is not

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* Hence, inflammation of the urethra is attended with leſs heat than inflammation of the ſkin.

always greater; for, in enterites, the ſenſation is very acute, owing to the nature of the part affected, or its ſenſibility, although the actual increaſe is perhaps not above one or two degrees more than its natural ſtandard.

All increaſed degrees of the natural action give the ſenſation of heat, whether more heat be really preſent or not; becauſe the effect of heat, or increaſed action, is produced. The ſenſation, and the ſubſtance which we call heat, are two different things, the one being an effect, the other a cauſe; or the one an action, and the other an agent. Now, the ſame effect may be produced by various cauſes: Thus, the application of zinc and ſilver, in a particular manner, to the mouth, will produce the ſenſation of light, as certainly as light itſelf. It muſt, however, be remembered, that,

with reſpect to the ſenſation of heat, as well as other ſenſations, different parts have different ſuſceptibilities. The ſenſation of touch is peculiarly confined to the cutis, that of hearing to the ear, &c. In the ſame way, ſome parts have a greater ſuſceptibility for receiving the ſenſation called heat, than others. This ſenſation is ſtrong in the ſkin and bowels; but, in the brain, muſcles, bones, &c. heat produces a ſomewhat different effect, and gives a ſenſation of a different nature. This is conformable to what we obſerve, in other inſtances, of the effects of foreign agents; for there is no fact better aſcertained than this, that agents often produce different effects, when applied to different individuals, or different parts of the ſame individual. Hence, in ſimple inflammation of glands, or other parts lying below the ſkin, with which it does not exhibit immediately the ſym-

pathy of aſſociation, we find, that there is firſt pain, with little heat, and then more heat, in proportion as the inflammation affects the cutis. As long as there is pain, without much heat, we may conclude, that the inflammation is not making a rapid progreſs toward ſuppuration; for, unleſs in ſome ſpecific inflammations, the ſurface always becomes affected, before matter is formed in the gland.

FROM theſe remarks, which are ſupported by facts, it will appear, that, in inflammation of the ſurface, the heat is produced in greateſt quantity by the cutis, whilſt the pain proper to inflammation is ſeated chiefly in the cellular ſubſtance.

ACTUAL heat, in inflammation, is chiefly produced by the cuticular veſſels;

and, unleſs theſe be affected, the degree of heat is not greatly increaſed, although, in very delicate parts, the ſenſation often is *. The ſenſibility, with regard to heat, of the cellular ſubſtance, the muſcles, the parenchymatous ſubſtance of the lungs and the liver, the ſubſtance of tendons, ligaments, brain, &c. is not great ; and, therefore, as the inflammatory action in them is not attended with the production of much actual heat, theſe, when inflamed, give more the ſenſation of ſimple pain, than of heat. On the other hand, the pleura, which is more ſenſible than thoſe parts, with regard to heat, when inflamed, gives both the ſenſation of ſharp pain, and alſo of moderate heat. The inteſtines, again, are, in this reſpect,

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* It has been aſcertained by Mr. Hunter, that the actual heat of the muſcles, or viſcera, is very little increaſed by inflammation.

highly fenfible, and, when inflamed, give the fenfation of intolerable heat, which is a pathognomonic fymptom of enterites.

It is impoffible to account for the variations which take place in the production of heat, by the inflammatory action, upon the mechanical principles which were once maintained, and which ftill are adopted by fome. It was the opinion of Boerrhave *, and others †, who wrote after the difcovery of the circulation of the blood, that the heat was produced, by the attrition of the red globules, againft the fides of the veffels; and the fame is embraced by a modern

* Boerrhave, Aph. 382.

† Sauvage, Nofologia Method. Tom. I. p. 383.

author *, as one caufe of this fymptom. But, by the philofophy which is now taught, it appears, that a fluid may flow with the utmoft velocity, through a pipe, for a thoufand years, without producing a fingle degree of heat: And our mechanics, regardlefs of the authority of either Pitcairn or Bell, feem ftill to believe, that, if they keep their machinery moift, there is very little danger of its being inflamed by the friction.

Fever.—The laft of the primary fymptoms of inflammation, is the general fever, or affection of the fyftem, which often attends it. This is fometimes idiopathic; that is to fay, it fometimes is produced at the fame time with the local inflammation, and by the fame caufes. At other times, it is fymptomatic; that

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* Bell's Treatife on Ulcers, p. 28.

is to ſay, it is produced, not directly by the cauſes which originally produced the inflammation, but ſympathetically by the local inflammation. Both of theſe ſpecies of fever, are, in this diſeaſe, produced exactly in the ſame way, although by different exciting cauſes; and the manner of their production may be underſtood, from the principles which are laid down in the preliminary diſſertation. The idiopathic fever is always preceded by coldneſs, becauſe the action is always formed ſlowly. This coldneſs is in the commencement real, and afterwards only ſenſitive. There is at firſt, owing to the diminution of the natural action, a diminution in the production of heat, and, conſequently, a feeling of coldneſs. This ſenſation continues for ſome time after the actual heat, in conſequence of the incipient, but imperfect action, begins to be increaſed, which has been attributed to a derange-

ment in our ſenſitive faculty: But it may be explained in a different manner; for, as increaſed action is productive of the ſenſation of heat, as well as frequently of the increaſe of actual heat, in thoſe organs which are peculiarly fitted to ſecrete it, ſo imperfect or diminiſhed action is productive of the ſenſation of cold. During the firſt formation of an action, there is actual coldneſs produced; but, after the action has begun to take place, there is heat produced in a certain quantity; but, from the imperfection of the action, cold is ſtill felt; becauſe the ſame ſtate which cold, or the privation of heat, produces, is preſent, namely, an imperfect ſtate of action. The ſympathetic, or ſymptomatic fever, ſometimes appears to be formed without any coldneſs; becauſe, from the violence of the exciting cauſe, or local inflammation, or the quickneſs of its operation, it is excit-

ed ſo quickly, that we do not attend to the ſymptoms of formation; but theſe, nevertheleſs, do take place, although, owing to this cauſe, their continuance be ſhort. If, however, the local inflammation be more ſlowly induced, and, conſequently, operate more gradually on the ſyſtem, then the coldneſs is evidently perceived *. The ſymptomatic fever, induced by ſcalding or burning a part, is quickly produced, and we have very little time to attend to the period of formation. On the other hand, the ſymptomatic fever, induced by wounds, is excited more ſlowly, and the period of formation is longer.

* Coldneſs is felt not only in the whole body, if a general action be ſlowly induced, but it is alſo felt in a particular part, in local actions, if theſe be gradually induced. Thus, before eruptions appear on particular parts of the ſkin, thoſe portions are often felt cold.

This fever is not produced by inflammation, if it affects parts only to a slight degree; but it uniformly appears, if the local inflammation be considerable, or, what is the same thing, affects very sensible parts; and, in these cases, the presence of this fever, is a criterion of the presence of inflammation, in parts where we would be led to suspect it, but cannot say decidedly from other symptoms. Thus, if, after lithotomy, the patient complain of pain in the abdomen, we will be led to conclude, that this proceeds from inflammation of the viscera, if it has been preceded by coldness, and accompanied with heat; but if no shivering has taken place, and the pulse be not much affected, it proceeds most probably from a different cause.

The degree to which this fever will be excited, depends not upon the abso-

lute quantity or violence of the inflammatory action, but, in a great meaſure, upon the degree of the local inflammatory action, compared to the natural power and action of the part. Thoſe parts whoſe action is naturally low, and, conſequently, whoſe energy is alſo ſmall, are extremely painful, when inflamed, and the ſyſtem ſympathiſes greatly with them, although the real quantity of inflammatory action, conſidered abſolutely, be trifling. Hence, inflammation of tendons, bones, or ligaments, affect the conſtitution greatly; and, from the ſame cauſe, it will appear, that agents which induce violent inflammation in joints, (by which I mean abſolutely great inflammatory action), will rapidly produce ſloughs of the part, and death to the patient, in no very long time, if it be not ſubdued. If, on the other hand, the agents have acted leſs powerfully, then

ſloughs are not produced, but the ſyſtem is as much affected, as it would be by a much greater degree of local inflammatory action in ſome other parts. Thoſe parts, again, which are very ſenſible, affect the conſtitution greatly, in the ſame way, and on the ſame principle nearly, as thoſe whoſe action is naturally low; becauſe ſlight cauſes induce the ſame diſproportionate action in them; and hence they are ſoon deſtroyed. In this way, inflammation of the bowels affects the ſyſtem greatly, and local mortification is alſo rapidly produced.

There is, however, another cauſe cooperating with this one, in the preſent inſtance, to produce a general ſympathy, namely, the natural ſympathy which exiſts betwixt the ſtomach and inteſtines, and the reſt of the body, by which injuries done to them affect the ſyſtem

very rapidly; a ſlight diſorder of the ſtomach, for inſtance, ſometimes producing ſyncope. This does not depend, as Mr. Hunter * ſuppoſes, upon the ſtomach being the receptacle of, what he calls, ſimple life; becauſe the exiſtence of ſuch

* "All the parts that may, in one ſenſe, be called vi-
"tal, do not produce the ſame effect upon the conſtitu-
"tion; and the difference ſeems to ariſe from the difference
"in their connections with the ſtomach. It is to be ob-
"ſerved, that vital parts may be divided into two; one,
"which is in itſelf immediately connected with life, as the
"ſtomach; the other, where life only depends upon it in
"its action or uſe: The heart, lungs, and brain are only
"to be conſidered in this laſt light."—"If the ſtomach
"is inflamed, the patient feels an oppreſſion and dejection
"through all the ſtages of the inflammation. Simple ani-
"mal life ſeems to be hurt or leſſened, juſt as ſenſation is
"leſſened when the brain is injured."

Hunter on Inflammation, p. 324. 325.

"The ſtomach is the ſeat of ſimple animal life, and
"thereby the organ of univerſal ſympathy of the materia
"vitæ." P. 402.

a receptacle is contrary to the general nature of the animal economy; and I know of no proofs which eſtabliſh its exiſtence.

Of the Conſequences of Inflammation.

HAVING made theſe remarks upon the production of the ſymptoms of inflammation, I ſhall now proceed to conſider its moſt frequent conſequences or terminations, which have generally been ſaid to be, adheſion or reſolution, ſuppuration, and mortification.

ADHESION.—To illuſtrate the important proceſs of adheſion, or the union of two living parts which have once been divided, it may not be improper to attend to the cauſe of reproduction in general, or the replacement of thoſe par-

ticles which are daily abſorbed. Neither abſorption nor reproduction can take place in a dead body, but depend entirely on the action of the living principle. If this action be impaired, theſe functions are imperfectly performed. If, on the other hand, it be too high, then thoſe proceſſes are too rapidly carried on, and the new matter which is depoſited, is incompletely organiſed; its life is likewiſe leſs perfect, and its continuance is ſhort. This is illuſtrated, by what we obſerve in ulcers and inflamed parts. The new matter, or the organic particles, are furniſhed entirely by the arteries, and depoſited by them, under the direction of the nerves; and the nature and organiſation of this matter varies with the action *. Theſe particles are furniſhed, at

* The action, at the ſurface, forms ſkin, and that in the muſcle, forms muſcle. As long as the actions of the

the moment of their formation, with the ſpecific life of the animal, in a degree proportioned to the perfection of the formation; and their natural longevity obſerves the ſame ratio. They live and die from the ſame cauſes which influence the life of the body, conſidered as a whole; but their duration is infinitely ſhorter than that of the body. They quickly periſh, or deſcend in the ſcale of exiſtence; they are alternately abſorbed and replaced. There is, thus, a continual round of death * and

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part remain the ſame, then a ſimilar matter is furniſhed; but when the action changes, then the matter alſo changes. Thus, for inſtance, bone is ſometimes formed in place of membrane, &c.

* Death is the deſcending of any ſubſtance from a higher to a lower ſpecies of exiſtence, or from a more perfect to a leſs perfect vitality: for there can be no ſuch thing as abſolute death, that is to ſay, complete deprivation of a vital principle, until the ſame Great Power who originally gave exiſtence to matter, be pleaſed, by his ſovereign will, to annihilate it.

reproduction going forward in the animal frame.

In order that this procefs may go on, or that reproduction may take place, it is neceffary, that a void be formed, by the abforption of the old matter; which void is filled up by new particles, which adhere together, and preferve the organifation of the part. If this void, inftead of being made flowly by abforption, and being filled up the moment that it is formed, be made fuddenly, and of a confiderable fize, by incifion, the fame effect is, in the end, produced. The arteries which we cut, pour out their blood, but the quantity is gradually diminifhed, until it ceafes altogether, and a different and more limpid matter drops out. This has been called, by fome, the lymph, and by others, the ferum, which filtered through the contracting veffels.

But, were this mechanical notion true, then, by varying the degree of preſſure, and thus changing the diameter of the veſſels, we ſhould, at pleaſure, make the diſcharge either red or limpid. It is more probable, that this is one of the moſt ſimple ſecretions which the blood yields, and that the appearance is regulated by the action of the veſſels. If the edges of the wound be laid cloſely together, we next find, that the divided veſſels, which have now become extremities, receive the action which the extremities formerly uſed to have, when a void was formed by abſorption *. They throw out matter nearly the ſame with that which was formerly yielded, and

* If, however, the void be larger than it ought to be, owing to the ſides of the wound not being laid cloſely together, then this proceſs does not take place, but the part inflames, as has been formerly explained.

the ſtructure of the part is reſtored. I have ſaid nearly; becauſe, from the attending circumſtances, the action cannot be ſo perfect as formerly; and, therefore, the matter furniſhed will not be at firſt exactly the ſame, and the deviation will be proportioned to the degree in which the action, in conſequence of the injury, is increaſed beyond what it was in health. Hence, in parts where the action was ſlow in its performance, and ſmall in quantity, the deviation will be moſt. Thus, when a bone is fractured, the callus is much ſofter than old bone; it is formed in greater quantity than formerly, and it requires ſome time before it is formed in the neceſſary degree of perfection, to enable the perſon to make uſe of the bone. But a ſimilar injury done to the ſkin, or a muſcle, will not be attended with the ſame effects; for the action is there, in health, much quicker and much greater: The de-

viation is, therefore, from the firſt, trifling, and ſoon ceaſes.

Some have conſidered the proceſs of adheſion in a more mechanical light, and have ſuppoſed, that the lymph was poured out, and glued the parts together, and afforded a bed, into which the veſſels from the oppoſite ſurfaces might ramify, by which union was produced. This takes place, in the opinion of Mr. Hunter, owing to the vitality of the blood; but I apprehend, that it is fully proved, that whenever blood is extravaſated, it loſes its animal life, and proves a ſtimulus to the wound, preventing it from uniting, unleſs the quantity be very ſmall, in which caſe it is abſorbed, and is thus removed. It is our great care, in ſurgical operations, to tie the veſſels, and clear the ſurface from blood, in order to procure union, which ought to be attended

with an effect contrary to our wishes, were adhesion to depend upon the uniting medium of the blood. Mr. Hunter likewise supposes, that coagula have the power of becoming vascular of themselves, and thus more firmly uniting the parts; but this is assuredly ascribing the actions of one species of life, and of one body, to that of another: We might as well attribute the actions of the life of a quadruped to the living principle of the polypus.

The perceptible operations of the life of the blood are very few, and quite distinct from those of an organised animal. If it ever were to perform other actions, and assume an organised form, then it must cease to be blood, and become a substance with which we have no acquaintance; for, hitherto, we know of no substance which can become a part of

an animal, and receive a regular form, except through the intervention of the nerves and veſſels, which, by regular gradations, change foreign matters into part of the animal. It has, indeed, been ſaid, that clots of blood have been injected; but, by the ſame experiment, we might alſo prove, that a ſponge, or a bit of woolen cloth, were alſo vaſcular.

Adhesion appears to be a more delicate proceſs, than joining parts with mucus, lymph, or any intermediate ſubſtance whatever. It appears to be nothing leſs than the action of that power, which is always operating in the ſyſtem, and reſtoring the waſte of the body; but, from the circumſtances under which it is exerciſed, and the cauſes which tend to make it imperfect, the ſubſtance which is thrown out is not always perfectly ſi-

milar to the adjoining parts, at leaſt in extenſive wounds.

THIS proceſs, which, when carried on in health, is called nutrition, has, in diſeaſe, been named the adheſive inflammation. But the term is improper; for adheſion never takes place, until inflammation ſubſides; and it often is produced without any previous inflammation, and quite independent of it, without heat, without pain, and without extenſive redneſs. Whenever a wound inflames, its lips ſeparate, and pain is produced: When the inflammation is removed, then the parts adhere, and the pain ceaſes. Adheſion is, in this caſe, ſynonymous with reſolution; indeed, reſolution is almoſt always attended with adheſion. There is, however, this difference betwixt them, that adheſion may take place without previous inflammation, whereas

resolution implies the existence of that disease. If, however, inflammation has preceded adhesion, then it is exactly the same with resolution, being a termination of the inflammatory action. He, then, who would talk of the adhesive inflammation, is just as much mistaken, as he who would speak of the resolving inflammation.

In the natural state of the body, we find skin adhering to cellular substance, and this to muscle, and this again to bone; and the same union takes place in disease, two dissimilar substances often joining together, or adhering; but, for this purpose, it is necessary that both be alive, and that the actions of both be in a proportioned degree.

These observations on adhesion, will serve to explain the termination of inflammation, called resolution; and, there-

fore, little more will be required to be ſaid on that ſubject. Reſolution is, by ſome, ſaid to be merely a ceſſation of inflammation, the parts returning gradually to their former ſtate, without any intermediate condition. But, if we attend more minutely to the ſubject, we ſhall find, that the inflammatory action, like every other new action, uniformly terminates by a ſecretion. Some actions terminate in new ſecretions, whilſt others only increaſe the quantity of old ones. When the inflammatory action ſubſides, we have an increaſed diſcharge of the proper ſecretion of the part, or interſtitial fluid, which is alſo conſiderably changed in its nature, and becomes thinner than it was during the continuance of the inflammatory action *. The part, there-

* It is owing to this, that, during reſolution, the part becomes ſofter, although the ſwelling be much the ſame as formerly.

fore, remains ſwelled, until this fluid be abſorbed ; but the ſwelling is more diffuſed and œdomatous, and the pain is gone, together with the redneſs. The organic particles are likewiſe depoſited in greater perfection, and may be ſaid to be a ſecretory termination of inflammation ; becauſe, during the violence of the inflammatory action, they were furniſhed in a very imperfect ſtate; and were different from what they ought to be: But, when reſolution is accompliſhed, they become again natural, and produce either adheſion, if there has been a diviſion, or a renewal of the proper ſtructure which has been deſtroyed by the inflammation, rendering the formative or nutritive action imperfect.

Suppuration.—If reſolution do not take place, owing to the original violence of the inflammatory action, or

from any other caufe, then, if the part be not killed, a fecretion of a different kind takes place, and the inflammation is faid to terminate by fuppuration.

Concerning the formation, nature, and ufes of pus, many opinions have prevailed; but, by much the moft univerfal, is founded on the ancient doctrines of fermentation. By the Grecian phyficians, pus was confidered as a concoction of the blood or humours, effected by the powers of life, or by nature; and, therefore, the ftate of ulcers was attended to very much by Hippocrates, in forming his prognofis, as he thus afcertained the degree of vital power, and the extent of the operations of nature. When the blood was effufed into the cellular fubftance, then it was fuppofed to undergo a fpecies of putrefaction or con-

coction, and to become converted into pus *.

When the component parts of the blood came to be well underſtood, and when the humoural pathology came to be illuſtrated by experiments, attempts were made to diſcover which part of the blood yielded the purulent matter. From ſome obſervations on the ſerum of the blood, Sir John Pringle was led to believe, that pus was formed by a concoction of the ſerum; for, by expoſing this fluid, for ſome time, to a heat equal to that of the human body, a depoſition was formed, bearing ſome diſtant reſemblance to pus, from which it was conſidered as allowable to con-

* "Suppurantur autem alterato ſanguine ac calefacto, "donec putrefactus talium ulcerium pus fiat."

Hippoc. de Ulceribus.

clude, that inflammation produced an effufion of ferum, and that this ferum was by heat converted into pus. This opinion was keenly maintained by Mr. Gaber, who adduced many experiments fimilar to that juft mentioned, in order to prove the doctrine. Upon thefe authorities, the doctrine of fermentation was adopted by Dr. Cullen, and copied from him by Mr. Bell, neither of whom feem to have remembered, that the productions which are yielded by an animal, either in health or difeafe, are yielded by proceffes peculiar to animal life, and which they cannot poffibly imitate by any fkill, or by the moft elaborate concoction. That heat will coagulate a fmall portion of the ferum, and make it furnifh a precipitate, is a well-known fact; but it does not thence follow, that it depofits pus. If the mere circumftances of becoming white and thick, were confi-

dered as the only neceſſary changes which a fluid muſt undergo, in order to be converted into pus, then the lymph would be a much better ſubject for experiment-makers to work upon, than the ſerum. Even the urine itſelf might be proved to be the ſource of pus; becauſe Sir John Pringle*, the great authority upon this ſubject, allows, that this excretion, in health, yields a precipitate entirely the ſame with that which is furniſhed by the ſerum, and which, he ſuppoſes, is a redundant portion of the nutritious matter eſcaping by the kidneys. But a poſitive proof againſt this opinion of concoction, is obtained, by conſidering the ſituations in which pus is formed; for we find it covering ulcers ſpeedily after they have been wiped clean. Now, had pus been formed from ſerum, this ſerum could never have had time to

* Obſervations, &c. p. 389.

have been digefted, and it would have been abforbed by the dreffings which were applied. Again, when the lungs become inflamed, in people who have water in the cheft, or when enterites is conjoined with dropfy, we find the inflamed vifcera covered with pus; but, unlefs inflammation has been prefent, we never find pus in hydrothorax or afcites alone. It muft, then, in the cafes where we find it, be confidered as a fecretion produced by inflammation, and not the refult of concoction, otherwife we fhould find it in every cafe of dropfy.

Some have fuppofed, that pus was produced by the diffolution of the inflamed part; but the putrefactive fermentation yields a very different product from pus: Befides, in ulcers, we daily obferve an abundant flow of matter, without the fmalleft lofs of fubftance.

It has been already mentioned, that the inflammatory action changes very much the nature both of the interſtitial fluid and organic particles; and theſe changes may be conſidered as approximations toward the production of pus, if we conſider this as the ultimate ſecretion which is to be formed. From the continuance and degree of the inflammatory action, the interſtitial fluid becomes ſtill more different from what it ought to be, and the organic particles become ſo imperfect, that they cannot ſupply the waſte of the part, or renew its ſtructure: The form of the part is then deſtroyed, and the cavity filled with a double ſecretion *,

* Namely, the new or imperfect ſubſtance yielded by the veſſels, which formerly depoſited organic particles, but eſpecially the changed interſtitial fluid: Theſe uniting, form one ſubſtance, which is called pus.

called pus *. These observations apply to parts of a simple nature; that is to say, parts which only form matter, to renew their loss by absorption, and interstitial fluid. But there are other parts, which have a third set of vessels, which are intended to secrete a matter not immediately subservient to the support of the part. When these parts are inflamed to such a degree, as to induce the purulent secretion, then this fluid will also be changed, and form a third component part of pus, as we observe, for in-

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* Pus has been considered as a peculiar fluid, of a simple and homogenous nature; but, from this doctrine, which I apprehend to be true, it will appear to be a compound body, consisting often of more secretions than one, and differing in different organs. The appellation of pus, however, is generally confined to a yellowish bland fluid, of the consistence of cream, which, like other animal secretions, contains a quantity of globules.

ſtance, in the mammæ, during lactation *, if the true glandular part has ſuppurated. If, however, the inflammation has been leſs violent, then the inflamed gland ſtill continues to yield a milky ſecretion; but the milk yielded by that gland is not the ſame with that furniſhed by the reſt. At other times, thoſe third ſet of veſſels yield the greateſt part of the ſecretion in inflammation, as we ſee in the urethra; but, in this caſe, the inflammatory action is moderate, and the organic particles and interſtitial fluid are not much affected; the firſt of theſe, at leaſt, forming no part of the diſcharge, being per-

* If the breaſts be not in a ſecreting ſtate when inflamed, then they are to be conſidered juſt as the ſimple parts above mentioned. They are likewiſe, even during lactation, to be conſidered as ſimple parts, if the cellular ſubſtance alone be inflamed, as is frequently the caſe; for the glandular portion does not always ſuffer in theſe caſes.

fect enough to remain as conſtituent parts of the organ.

This proceſs takes place, in different ſpecies of inflammation, with different degrees of rapidity; and the proportion of the different ſubſtances which form pus alſo varies. In ſimple inflammation, the quickneſs of the proceſs depends, in part, upon the nature of the organ affected, but chiefly upon the violence of the action. The component parts, again, depend chiefly upon the nature of the part affected, but alſo, in part, on the degree of action. When bones inflame and ſuppurate, which they do ſlowly, it is chiefly the interſtitial fluid, in a changed ſtate, which is furniſhed, the diſcharge being thin, and often greaſy *. Tendons

* We muſt diſtinguiſh betwixt the fluid which comes from the bone, and that which is furniſhed by the ulcer of the ſoft parts which cover it.

yield both the interſtitial fluid, and part of the organic particles, but chiefly the fluid which lubricates their ſurface. Muſcles, the brain, parenchymatous ſubſtance of the lungs, liver, &c. and cellular ſubſtance, yield both interſtitial fluid, and organic particles, in the ſame proportion, in equal degrees of inflammation; and the diſcharge is little different, to appearance, in theſe different parts. Lymphatic glands* yield chiefly the interſtitial fluid, but alſo partly the organic matter, and moſt likely part of the lymph which they tranſmit. The conglomerate glands yield both the interſtitial fluid and organic particles; but the latter, unleſs in violent inflammation, are in ſmall quantity: They

* Lymphatic glands are, in one view, to be conſidered as ſecretory organs; for they undoubtedly give out the lymph in a different ſtate from that in which it entered them; otherwiſe we can perceive no uſe for them.

alſo yield their own peculiar ſecretion, in an altered ſtate. The teſticles, for inſtance, when they ſuppurate, give a diſcharge, which conſiſts of theſe three ſubſtances, but chiefly of the firſt, next of the laſt, and in leaſt quantity the organic matter. Along with this is diſcharged the old ſubſtance of the teſticles, (which has not been yet abſorbed), like threads. Mucous membranes, when they ſuppurate, yield chiefly their uſual diſcharge, in an altered ſtate, next the interſtitial fluid, in a ſmaller quantity, with ſcarcely any organic matter, the inflammation being ſeldom ſo high as to deſtroy its organiſation.

THE chills which precede extenſive ſuppuration, or ſuppuration in delicate parts, are to be accounted for upon the general principle already mentioned, of every new action being preceded by

ſymptoms of weakneſs during its forma-tion. Mr. Hunter ſuppoſes that the ſtomach is the great cauſe of thoſe ri-gors, in conſequence of its being "the "ſeat of ſimple animal life, and thereby "the organ of univerſal ſympathy of "the materia vitæ." It is, therefore, affected in all diſeaſes; and the ſame ef-fect is produced, as if directly injurious cauſes were applied to itſelf; which "diſagreeable applications" produce cold-neſs: But it ſurely does not follow, that, becauſe whatever excites ſqueamiſhneſs, induces a temporary feeling of cold, therefore cold is always induced, in diſ-eaſe, by a ſimilar ſtate being excited.

The coldneſs which precedes ſuppura-tion, is great or little, according to the ſame cauſes which influence the degree of the cold fit which precedes inflamma-tion, namely, the extent and degree of

the action, and the delicacy of the part affected. The effect upon the system, of the purulent action, after it is fully formed, is likewise proportioned to these circumstances. Every local action, if extensive or violent, or if it exist in delicate parts, must affect the constitution, and induce a general disease. This is uniformly an affection somewhat similar to the local action, although the symptoms be in a much less degree, and sometimes different. Thus, the local inflammatory action produces pain, heat, redness, and swelling; but the general action produces only heat, slight redness, and uneasiness, partaking rather of the nature of anxiety than pain. In the same way, the purulent action, which is a depraved action of the formative vessels of a part, produces, when it affects the system, an universal affection or derangement of these vessels, or a diseased action

in them, marked by frequency of pulse, and emaciation; the function of nutrition, or the deposition of organic particles, not being properly performed *. It is to this cause, I apprehend, and not to the mere formation of a quantity of fluid, called pus, that we are to attribute the bad effects of extensive suppuration, or ulcerations, or suppurations of the vital parts; for we cannot suppose, that weakness, or hectic fever, is induced, by these abscesses or ulcers acting merely as drains, destroying a certain quantity of blood, or nutritious fluid; otherwise the effect must always be proportioned to the quantity of matter, which is not uniformly the case.

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* Hectic fever is never produced, except by such causes as affect the action of nutrition; such as the purulent action, swelling of the mesenteric glands, diabetes, &c.

When matter is formed in a part, it is ſometimes removed by abſorption: The ſides of the abſceſs are thus allowed to come together, whilſt the purulent action abates, and the nutritive one returns, in conſequence of which the part is again reſtored to its proper condition. But, more frequently, the purulent action extends toward the ſurface; (for all actions tend thither;) which, conſequently, has its organiſation deſtroyed, the veſſels of the cellular membranes and cutis forming pus; ſo that, at laſt, at ſome particular part where the purulent action has advanced moſt, the matter comes to be covered only with the cuticle, which ſoon burſts, and allows the pus to eſcape: The abſceſs is then healed, in the ſame way as in the former inſtance, and both in the ſame way nearly as ulcers, which will be immediately illuſtrated; and, therefore, I ſhall not ex-

plain here the mode by which abſceſſes are healed.

It is in conſequence of the tendency of all actions to affect the ſurface, and approach to it, that abſceſſes ſpread outward, inſtead of extending laterally, or inward *. The matter has been ſuppoſed to be prevented from ſpreading through the neighbouring parts, by a coat of coagulated lymph, which lined the abſceſs; but it rather appears, that the whole of the inflamed part does not ſuppurate, but that ſuppuration begins firſt either about the centre, or rather ſomewhere

* Mr. Hunter attributes this to abſorption, produced by preſſure, which acts more upon the external ſurface, than the ſides or bottom, owing to "a readineſs in the "parts to be freed from a diſeaſe already exiſting." The cellular ſubſtance is likewiſe ſuppoſed to be "more ſuſ-"ceptible of this irritation" than other parts, and, conſequently, is more quickly abſorbed.

between the centre and the external ſurface, leaving a hard portion below, and on every ſide of it: This gradually grows leſs; but ſtill the purulent action has reached the ſurface, before it has affected the lateral margin; and, therefore, there is always a hardened portion ſurrounding the abſceſs, until it burſts, and for ſome time aftewards: But this hardened circle, or ſtool, as it has been called, is not formed by an effuſion of lymph, induced for the purpoſe of confining the matter, but is the conſequence of the whole of the inflamed part not having yet aſſumed the purulent action.

When a conſiderable portion of the ſurface has aſſumed the purulent action, then the abſceſs becomes expoſed, and an ulcer is ſaid to be formed, which is healed by the ſame proceſs which heals an abſceſs, when it diſcharges its matter

by a ſmall opening, or when the matter is abſorbed; namely, the natural action ſlowly returns, the purulent one diſappearing, and the proper organic particles being again replaced.

The veſſels which depoſit organic particles, ſeem to receive their natural action firſt, throwing out what are called granulations, whilſt the veſſels which ſecrete interſtitial fluid, are longer of receiving their proper action, and ſtill yield a purulent diſcharge; but this is not, as muſt be evident, exactly the ſame with the pus of abſceſſes.

Even the whole of the veſſels which furniſh organic particles, do not receive the action at the ſame time; but one veſſel after another ſeems to loſe the purulent action, and depoſit proper granulations, which, from the vaſcularity of

the part, are ſoft, and of a red colour. Theſe, from the imperfection of the action which forms them, in the beginning of the healing proceſs, die ſoon, and are quickly abſorbed; but they are as ſpeedily reproduced, and every day renders them more perfect, and brings them nearer to their natural longevity. The formative action ſeems, at firſt, to balance the abſorbing action, and the part remains, to appearance, the ſame; but, after a little, the granulations are formed faſter than they are abſorbed; the ulcer is, therefore, filled up, and the excavation obliterated. When the ulcer is filled up to the level of the ſurrounding parts, or nearly ſo, we then find the action of increaſe ſtop, and the part remain ſtationary. This depends upon the original laws of the conformation of the ſyſtem, by which a certain ſtructure is, in every part, produced; and, being once

produced, has a tendency to continue. The granulations are alſo prevented from riſing higher, by the action of the ſurrounding parts, of a ſimilar nature, each portion of an organ ſympathiſing with the reſt, and having its action regulated, to a certain degree, by that of the reſt. It is owing to theſe cauſes, that the granulations, in a healthy ulcer, do not ſhoot beyond the ſurface, but become covered with ſkin, the ſkin-forming action of the neighbouring ſurface ſpreading to the ulcer, whenever it becomes nearly level with it; that is to ſay, whenever it is ſuſceptible of receiving this communication of action. The cicatrizing proceſs begins firſt at the margins, both becauſe the depth is originally leſs there, and, therefore, the granulations ſooner riſe to the proper level, and alſo, becauſe they are in the immediate vicinity of the ſound ſkin, and, conſequent-

ly, have the action firſt communicated to them. Sometimes, indeed, the cicatrizing action is aſſumed by different ſpots, on the ſurface, or diſk of the ulcer ; but, in this caſe, it is frequently diſeaſed, an unhealthy covering being produced, which ſoon dies.

The cicatrix is at firſt thinner and ſofter than ſound ſkin, and conſiſts only of one layer, called cutis ; but, afterwards, the action becomes more perfect, and both cuticle and rete mucoſum are produced. This gradation toward perfection, begins, owing to the communication of action, at the margins ; and, therefore, the cicatrix ſeems to grow leſs and leſs, or contract itſelf, owing to new circles of perfect ſkin being ſlowly formed.

When the ulcer is unhealthy, then

this proceſs of healing is interrupted, imperfect granulations are thrown out, and the cicatrizing action is alſo diſeaſed, a thick inſenſible ſubſtance, called callus, being formed in the ſtead of thin cutis. The ſame cauſe which affects the formation of the granulations, affects alſo the diſcharge, which becomes different from what it was in the healthy ſtate, being ſometimes thicker, but oftener thinner.

A HEALTHY ulcer is not attended with much pain, but rather with a kind of ſmarting, part of which, perhaps, may be attributed to the dreſſings, or other cauſes, acting mechanically on it: But, when the ulcer becomes unhealthy, from a change in the action, then pain is, in many caſes, produced.

SUPPURATION and ulceration are actions complete in themſelves, and quite

different from the inflammatory one, being no otherwiſe connected with it, than as depending upon it originally for their production. Whenever an ulcer aſſumes the inflammatory action, then the ulcerative action ſubſides *, and the ſuppuration leſſens †, in a degree proportioned to the violence of the inflammatory action.

THE ulcerative action conſiſts of two

* The term ulcerative, does not neceſſarily imply a continuance of the deſtruction of parts, or any corroding property, otherwiſe theſe remarks would not be juſt; for inflammation may deſtroy the ſubſtance of the ulcer, and make it larger, by a ſpecies of mortification, although the ulcerative action be injured and leſſened.

† This has been obſerved ſo long ago as the days of Hippocrates, who takes notice of the bad effects which follow from the inflaming of wounds in ulcers: "Igneum "enim fervorem hoc inducit, ubi horror et pulſatio acceſ-"ſerit." *De Ulceribus.*

parts, the granulating and the purulent: The first is a natural action, the last a morbid one; but these two are so connected, as to render it impossible that the one should be rendered unhealthy, without the other also being affected, both conjoined forming a perfect and distinct action, different from the inflammatory one in its nature and consequences, and different also from the suppurative one; for, in this, no granulations are formed, but the vessels which used to deposit them, secrete a fluid, or purulent matter. These actions, although distinct from each other, may yet be converted the one into the other.

The inflammatory action naturally terminates in the suppurative*; and this may

* The suppurative action belongs to the order Glandulares of the class Mixtæ.

either continue for ſome time ſtationary; and then terminate in the ulcerative, or it may continue to increaſe. In the firſt caſe, the ſuperficial veſſels of the abſceſs, or wound, throw out pus, whilſt thoſe immediately below it, retain nearly their natural action, or form organic particles. In the ſecond caſe, one layer of veſſels after another, if I may uſe the expreſſion, aſſumes the ſuppurative action, and the excavation increaſes, from the loſs of power to form organic particles. When the ſuppurative action terminates in the ulcerative *, then the veſſels which uſed to form organic particles, regain their natural action ſlowly, and one after another; whilſt the other ſet of veſſels, or thoſe which threw out interſtitial flu-

* The ulcerative action, when ſimple, belongs to the order Ulcerantes of the claſs Mixtæ.

id, yield ſtill purulent matter *. If the ulcerative action be perfect and healthy, then the ſtructure of the part is ſlowly renewed, and the interſtitial fluid of the reſtored part becomes natural; the quantity of pus, therefore, gradually diminiſhes, its ſource being leſſened.

If, however, from any cauſe, the ulcerative action ſhould be converted into the ſuppurative, then granulations are no longer formed, and the part either remains ſtationary, or the ulcer ſpreads, according to circumſtances.

Simple ulcers, or ulcers where there is no morbid or ſpecific action conjoined with the ulcerative, may be divided into five genera, which conſiſt of ſeveral ſpe-

* It is by the ulcerative action that all abſceſſes are healed, and that all loſs of ſubſtance is replaced.

cies and varieties, which will be attended to in confidering the cure.

First, The healthy, or healing ulcer, in which the ulcerative action exifts in perfection.

Second, The indolent ulcer, in which the action is diminifhed, and, confequently, rendered more or lefs imperfect.

Third, The overacting ulcer, in which either a part, or the whole, of the ulcerative action is increafed. This is divifible into two fpecies: Firft, when only a part of the action is increafed; fuch as the granulating, forming fungus: Second, when the action, confidered as a whole, is increafed, and carried on with greater quicknefs; in which cafe, the granulations are formed very imperfect-

ly, and with very little longevity; the discharge alſo is changed.

Fourth, The inflammatory ulcer, in which the ulcerative action is changed into the inflammatory.

Fifth, The ſuppurative ulcer, in which the ulcerative action is changed into the ſuppurative *.

The ſymptoms and conſequences of theſe changes will be attended to, when the cure comes to be conſidered.

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* Theſe two laſt genera cannot properly be called ulcers, if we confine this term to parts poſſeſſed of the ulcerative action; but if we adhere to the common acceptation of the word, or conſider them merely as ſolutions of continuity, yielding a purulent diſcharge, then the diviſion is ſufficiently correct.

It has been ſuppoſed by ſome, that ulcers healed rather by the circumjacent parts ſinking down to the level of the bottom of the ſore, than by the formation of granulations, and the renewal of the loſt ſubſtance. This doctrine was particularly maintained by M. Fabre, a French ſurgeon, who ſuppoſes, that the depth of an ulcer depends chiefly upon the ſwelling of the ſurrounding parts, and very little upon the real loſs of ſubſtance; and, therefore, that the cure muſt be accompliſhed chiefly by the ſubſiding of the neighbouring parts, which is produced either by amaigriſſement or ſuppuration. When the parts have ſubſided as much as poſſible, then a cicatrix is formed, which is ſomewhat hollow, or concave, owing to the loſs of ſubſtance, which has not been renewed; but this hollow ſoon diſappears, owing to the fattening of the parts below it.

This doctrine may, in part, be admitted; for, in many cafes, we obferve the amaigriffement of the parts very diftinctly. In all cafes, it may be obferved to a certain degree; for, in every inftance, a fwelling at firft accompanies the ulcer; and this often, although not always, makes it appear to be deeper than the real lofs of fubftance would occafion. In extenfive ulcers in large members, we alfo obferve, that, by the emaciation of the part, the fides approach nearer together, and the ulcer is healed with lefs difficulty, than it otherwife would be; and we often find it ufeful, by proper bandages, to affift this procefs. But, that granulations are formed, and that they are the chief fource of the healing of the ulcer, is a point eftablifhed beyond all controverfy, and which may be afcertained by looking at any ulcer on the tibia.

Mr. Hunter ſuppoſes, that the healing of an ulcer is much accelerated, by what he calls the "contraction of the "granulations." The edges of the ulcer, he imagines, are brought nearer to each other, by the granulations contracting, like little muſcles, the effect of which is increaſed, by ſome of the granulations being abſorbed; in conſequence of which the reſt fall cloſer together. "Beſides "the contractile power of the granulations, there is alſo a ſimilar power in "the ſurrounding edge of the cicatrizing ſkin, which aſſiſts the contraction of "the granulations, and is generally more "conſiderable than that of the granulations themſelves, drawing the mouth "of the wound together, like a purſe *."

Were granulations to contract them-

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* P. 484.

ſelves, by any muſcular power, they muſt certainly have this proceſs inſtantaneouſly accelerated, by the application of ſtimuli, and muſt exhibit periods of relaxation, which they are not obſerved to do. Were the contraction of the ſore to depend upon any power of the margin to act as a ſphincter, we ſhould find, that the ſame cauſe ought to make an ulcer conſequent to a crucial inciſion larger, and prevent it from healing ſo ſoon, or with ſo ſmall a cicatrix, as it otherwiſe would do, which is not obſerved to occur. Were the contraction to depend upon interſtitial abſorption allowing the particles to fall nearer each other, or collapſe, by the power of gravity, then it muſt, in its degree and effect, be regulated entirely by the permanent poſture of the limb, or ſituation of the ulcer; for, at one time, it muſt make the ſides fall nearer each other,

and, in oppoſite circumſtances, they muſt recede; but this, like the former occurrence, we do not obſerve.

Granulations, when new-formed, are more vaſcular, and more luxuriant, than afterwards; and, therefore, when they become more natural, or leſs ſpongy, they will occupy leſs ſpace, and may tend, if the ſkin be relaxed, to bring the ſides nearer together, by their condenſation. The granulations, ſome time after they are produced, both receive leſs blood, and have leſs interſtitial fluid: The interſtices of the ſore muſt, therefore, approach nearer together, and will, by the attractive power of the life which they poſſeſs, cohere more firmly together*. They likewiſe poſſeſs a more

* It has been mentioned in the preliminary diſſertation, that the life of animals ſtill retains the property termed

perfect life than at first, and, therefore, have a more perfect union. On these accounts, the disk of the ulcer may be lessened, by the approximation of its different particles. The sides may also approach together, in extensive ulcers in large members, by the emaciation of the parts, which lessens the diameter of the limb, and, consequently, allows the skin to cover more of the ulcer.

The contraction of the superficies, dependent on the operation of these causes, is different in degree, in different in-

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attraction, and which belongs to the vital principle of matter, from which it is derived. It was likewise mentioned, that this property seems to be increased, by the elevation into a higher species of life. It is by this property, that the different parts adhere together; and the degree of adhesion depends upon the quantity and perfection of the life, and the proximity of the organic particles to each other.

ſtances. It is not, however, ſo great as it appears at firſt ſight to be; becauſe the cicatrix, which is firſt formed at the margins, is very thin and imperfect; but, in a ſhort time, the action becomes more perfect, and the abſorbed matter is replaced with ſkin more exactly reſembling the neighbouring ſurface. We, therefore, imagine, that the old ſkin is contracting, or approaching inward, whilſt it is in reality the new ſkin which is becoming ſimilar to the old.

The ulcerative action, chiefly perhaps in conſequence of the purulent one, which makes a part of it, has a tendency to affect the conſtitution, and induce a general action, called hectic. The ſymptoms of this diſeaſe are, alternate chills and feelings of heat, accompanied by a frequent, ſmall pulſe, which is alſo generally at firſt ſharp; by loſs of appe-

tite, thirſt, diarrhœa, colliquative ſweats through the night, emaciation of the body, with great weakneſs: The urine is generally pale *. This action is always greateſt at the time when the natural action is naturally loweſt, namely, in the evening; and theſe exacerbations are generally preceded by chills; for all actions which are renewed at ſtated periods, or experience conſiderable augmentations, exhibit, in a greater or leſs degree, the ſymptoms of the period of formation. This action is dangerous, in a degree, or proves fatal with a rapidity, proportioned to the quickneſs with which it is induced; and hence, when, by any cauſe, it is ſpeedily produced in people who previouſly were tolerably healthy, it often proves fatal in the courſe of a few days. I have known a man die within

* The cheeks are alſo generally fluſhed before death.

a week after opening a lumber abſceſs, although, at the time of the operation, he was pretty ſtrong.

This diſeaſe has been attributed to the abſorption of matter from the ſore; but, when we conſider, that the hectic is not produced by ſores, with a certainty proportioned to their ſize and abſorbing ſurface, but is dependent chiefly upon the nature of the part affected, and the ſpecific qualities of the local action, we will be led to drop this opinion, and will rather aſcribe it to an extenſion of the action, or a general morbid condition, induced ſympathetically by it, in the method already mentioned, when treating of ſuppuration. As a confirmation of this, it is to be remarked, that the degree and continuance of the local action, and the nature of the part affect-

ed by it, have the chief influence in producing the hectic.

The ſame cauſes which regulate the effect of the inflammatory action upon the conſtitution, regulate alſo the effect of the ulcerative action. When this action, therefore, takes place in the lungs, heart, ſtomach, joints, &c. then the hectic is very certainly induced. It is likewiſe produced by the long continuance of this action, if extenſive, in parts which are leſs delicate, and which do not act quickly upon the ſyſtem; ſuch as the cellular ſubſtance; but it is much more readily induced in the former caſe, when delicate and vital parts are injured. The peculiar ſtate of the action itſelf, likewiſe influences the production of this diſeaſe; for healthy ulceration is leſs apt to occaſion hectic, than the diſeaſed or unhealthy ulcerative action, although, in

both cafes, the fame fpot be affected. Hence, fcrophulous ulcers affect the conftitution more than many others of the fame fize; and hence alfo, the influence of the external air in producing hectic, by injuring the ulcerative action. Whenever an agent operates on any part which is not accuftomed to its action, or to which it is not to be confidered as a natural ftimulus, then difeafe is produced, or the action is changed, unlefs the power of the agent be very inconfiderable. The air is to be confidered as a natural ftimulus only to the lungs and furface of the body; and, whenever it operates on any other part, it tends to injure the natural action of that part. When atmofpheric air is taken into the ftomach or bowels, or is blown into the cellular fubftance, the action of thefe parts is flightly injured; when introduced into the blood-veffels, a more ferious evil is

frequently induced. But the bad effects of the air is more clearly ſeen, when the part on which it operates is previouſly under the influence of a diſeaſed action. The ſuppurative and ulcerative actions, are merely the formative actions of the part, or its natural action rendered morbid ; and theſe formative actions are naturally carried on without the preſence of the air, which would tend to impede them ; but it will operate ſtill more viſibly and powerfully, in changing the nature of the actions, into which they are transformed by diſeaſe, rendering theſe actions ſtill more imperfect and unhealthy ; that is to ſay, different from the condition which enables them to terminate again in the natural formative actions, by the alteration of which they were produced. When an abſceſs is opened, and the air thrown in, the diſcharge becomes thin and copious, and

the healing procefs is interrupted. When an ulcer of the furface is expofed long to the action of the air, then it becomes foul and unhealthy *. When an abfcefs of an internal part, or cavity of the body, is opened, or burfts externally, fo as to allow the air to come in contact with it, then the conftitution becomes affected, the hectic action is uſhered in with fhiverings, the appetite fails, and, although the health has been previoufly good, yet the patient often dies in a few days.

THERE are, then, three caufes which tend to produce hectic: Firft, the exiftence of the fuppurative or ulcerative action, in delicate or vital parts; and this

* This change of the ulcer is not fo apt to produce hectic, as a fimilar change of the internal ulcers or abfceffes; becaufe the one naturally produces lefs effect upon the conftitution than the other.

tends quickly, at leaſt, comparatively ſpeaking, to induce the hectic action. Second, the long continuance of the ulcerative action, to a conſiderable degree, in leſs delicate parts; ſuch as the cellular ſubſtance, &c.: This acts much more ſlowly than the other cauſes. Third, the ſpecific or peculiar qualities of the action; ſuch as ſcrophulous action, or deviations conſequent to the action of the air upon parts where it is to be conſidered as unnatural. The effect of the qualities will be much increaſed by the nature of the part affected; for the ſame cauſes operating upon ulcers of the ſurface, will not produce the ſame effect on the conſtitution, as when they act on ulcers of internal and vital parts. Hectic will likewiſe be ſooner produced in thoſe who have an irritable habit, than in thoſe who ſympathiſe leſs quickly and leſs eaſily.

THE hectic fever, from whatever caufe it may be induced, always exhibits certain fymptoms which are effential to it, and which have been already mentioned. But, in addition to thefe, others may alfo occur, owing to the peculiarity of the caufe; and perhaps no two hectics (induced by different caufes) are exactly fimilar in every circumftance, although the difference may be fuch as cannot be perceived or detected. There may be, for inftance, and undoubtedly is, a difference in the hectic induced by a fimple ulcer, from that occafioned by a fcrophulous one, or a cancerous one. I have feen the hectic, or difeafed formative or nutritive action, accompanied by an emphyfema, when it was induced by an abfcefs, which had an emphyfematous action. A man had a feton paffed through a tumor on the neck, but very little difcharge took place immediately.

In the courſe of four and twenty hours, the tumor yielded more fluid, which iſſued alongſt with a bubbling of air; at the ſame time, hectic came on, and air was extricated into every part of the body. He died within two days after being taken ill; and, on opening him, I found air contained in the heart, veins, ſcrotum, and every cavity of the body, and through the whole cellular ſubſtance. The tumor had not the ſmalleſt communication with the trachea; and, therefore, neither the local nor general emphyſema, could be attributed to the mechanical introduction of atmoſpheric air. Here, then, was an inſtance of a peculiar modification of the hectic, owing to the peculiarity of the local action, which could be better obſerved than many of the leſs ſenſible qualities.

Mr. Hunter ſuppoſes, that hectic is

a diseased state, induced by an incurable disease, or " a constitution now become affected with a local disease, or " irritation, which the constitution is " conscious of, and of which it cannot " relieve itself, and cannot cure *." But, setting other arguments aside, against this opinion, we find, that, in very irritable people, abscesses sometimes produce hectic, for a week or two, which goes of, when the abscess naturally heals. In consequence of this opinion, Mr. Hunter supposes, that the affection of the constitution, which takes place when a sore, (as, for instance, a compound fracture,) has gone the length of forming granulations, that is to say, begins to cure, is not true hectic, but a disease, which he calls " dissolution," by which he means the state ushering in dissolution. But

* P. 497.

this, I apprehend, from the view which has been given of the ſubject, will appear often to differ, in no reſpect, from hectic; only, it proves fatal ſooner than this diſeaſe, in ſome other inſtances, does. At other times, indeed, the ſore may induce the ſtate of ſimple weakneſs, uſhering in death, without hectic; and, in this caſe, the term "diſſolution" may be ſufficiently proper.

There are, therefore, two ſtates which may be induced by inflammation, and both terminate in death; the hectic ſtate, and the ſtate of ſimple weakneſs. The firſt is illuſtrated by the effect of ulceration; the ſecond, by the effect of inflammatory fever. It is merely the forerunner of death, and, therefore, will ſucceed almoſt every diſeaſed action. But, although it, in moſt caſes, precedes death, yet death does not uni-

verſally ſucceed it; for, as will be immediately mentioned, it may be induced by the ſudden ceſſation of actions, when there is ſtill power to recover by proper aſſiſtance.

The condition of the body immediately before death, is, I believe, generally that of ſimple weakneſs, unleſs when induced by mortification, or ſimilar diſeaſes, as will be preſently mentioned. It is, at leaſt, ſo far a ſtate of ſimple weakneſs, that, in moſt caſes, the ſpecific diſeaſes diſappear; and, could the patient be reſtored to ſtrength by any power, he would, in all probability, be free from the peculiar morbid action which formerly exiſted *.

* This is farther confirmed, by obſerving, that this ſtate, when it is curable, is cured by ſuch remedies as

This weaknefs, as Mr. Hunter has obferved, may affect one part of the body, or particular functions, lefs than others. On this account, the circulation is often carried on with more ftrength, or apparent ftrength, than is proportioned to the ftate of the fyftem; and, therefore, death may be nearer at hand than we would imagine.

In the preliminary differtation, it was mentioned, that all actions which fubfide fuddenly, weaken moft. This ftate may, therefore, be quickly and unexpectedly induced, by fuch caufes, feen or hidden, as produce a fudden diminution of the morbid action. It may, therefore, take place, although the patient be re-

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are ufed againft fimple weaknefs, and not by the remedies which we employ againft the fpecific difeafe which produced it.

coverable; that is to ſay, although the powers of life be not abſolutely exhauſted, or worn out.

If long continued and extenſive ulceration be productive of injury to the conſtitution, by exciting a general action, attended with a deviation in the nutritive action, in a manner already explained, ſo is alſo, in many inſtances, the ſudden loſs or abſence of this ulcerative action injurious. If the conſtitution have been long accuſtomed to this ſecretory action, the ſtoppage or ceſſation of it is apt to induce, in ſome other organ, an excretory action, although of a ſomewhat different kind, at leaſt if there be any tendency to this, on account of age, conſtitution, &c. Thus, the hemorrhagic action may ſupervene, upon the ceſſation of the purulent action, and may affect either the brain, lungs, or ſtomach, ac-

cording to circumſtances; or the action of exhalation, into particular cavities, may be produced, giving riſe to hydrothorax, aſcites, &c. Theſe effects, however, are leſs apt to be produced, if hectic have been induced by the ulcer before it was healed; becauſe then the general action ſeems to diminiſh the tendency of particular parts to be affected. If we amputate on account of a large ulcer, the patient is more apt to become apoplectic, if he has had no conſiderable degree of hectic, than if this diſeaſe has made a greater progreſs; but, at the ſame time, if we have allowed it, on the other hand, to go too far, then the ſyſtem cannot recover, although we remove the exciting cauſe, but the operation will rather tend to accelerate the death.

The bad effects of healing old ſores, without proper precaution, has been at-

tributed to the ſtoppage of a quantity of fluid, which produces a redundance, or plethora; and, therefore, "adequate "drains," or iſſues, have been prepared: But, although iſſues may be proper, in many caſes, to prevent, by the continuance of an ulcerative action, the production of a ſecretory action, in more important parts, yet it does not follow, that iſſues act by draining off the fluids, as Mr. Bell ſuppoſes, nor that the healing of ulcers produces a plethora. If ſo, we muſt produce an iſſue almoſt as large as the old ſore; at leaſt, a ſmall iſſue will do no good. We might alſo, by ſpare diet, abſtinence from fluids, bleeding, purging, &c. produce the ſame effect with an iſſue, which nobody expects will be the caſe.

Some have ſuppoſed, that when old ſores were healed, a peculiar morbid hu-

mour, which they were wont to discharge, was retained * ; but this opinion is now almoſt abandoned.

Mortification.———Mortification, ſtrictly ſpeaking, implies nothing more than merely death ; but, in its general acceptation, it is made alſo to comprehend the putrefaction of the part which is killed ; for, as the dead portion ſtill adheres to the living, until this proceſs takes place, the putrefactive fermentation has been always conſidered as ſynonymous with mortification, and as conſtituting one of its neceſſary ſymptoms. This diſeaſe, then, will be induced by whatever can kill the part, whether by ſubducting directly ſtimuli neceſſary for life, or by exciting an action greater than the power of the part can continue

* Morgagni de Sed. et Cauſ. &c. Epiſt. LV. *a.* 13.

to perform. An inſtance of the firſt we have in the effects of long continued cold, compreſſion of the arteries, &c. In thoſe caſes, the parts being deprived of neceſſary ſtimuli, die ſlowly, and run gradually into the putrefactive fermentation *. This, however, only happens from the ſubduction of neceſſary ſtimuli, when the injuring cauſe is very powerful, or when ſome agent excites an action afterwards in the weakened parts; in which caſe it belongs to the next diviſion, which is illuſtrated by the effects

* In ſome rare inſtances, the part becomes quite dry and hard, conſtituting what has been called the dry gangrene, to which the epithet white has been added, when the parts preſerved their colour. The term gangrene, however, is here improperly applied. I have known one inſtance, in which the limb became cold, inſenſible, and quite black, but not dry. It evidently, however, was not gangrenous; becauſe it afterwards recovered its powers, to a certain degree, and loſt the black colour, becoming of a yellow tinge.

of lightning, inflammation, or whatever can increaſe the action beyond what the power is able to ſuſtain.

Mortification is moſt likely to ſucceed to inflammation, in four different circumſtances.

First, When the inflammation is very violent and extenſive; occurring in parts which were formerly healthy, and not remarkably delicate, poſſeſſing naturally a conſiderable degree of action, as, for inſtance, the cellular ſubſtance, &c. Mortification more rarely takes place in this caſe.

Second, When the inflammatory action occurs to any conſiderable degree, in parts where the action is naturally little, as, for inſtance, in tendons, &c.; or where it ought, in conſequence

of previous diſeaſe, to be little, as, for inſtance, in parts which have been weakened by cold, or in people who have had fever or palſy, &c.

Third, When the inflammatory action affects parts which are naturally very ſenſible, and very ſuſceptible of having action eaſily induced in them, ſuch as the inteſtines, the cutis, &c.

Fourth, When the inflammatory action is complicated with ſome other morbid condition, being produced by one of the agentes diſſimiles, ſuch as peſtilential carbuncle, &c. *

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* Some gangrenous affections are epidemic, whilſt others are endemic. Morgagni mentions from Brunnerus, a particular gangrene of the legs, to which the inhabitants of the Black Foreſt were ſubject, and which they were willing to attribute to the uſe of bad rye. Epiſt. LV. a. 24

Mortification may, in one point of view, be compared to the natural procefs of the diffolution and abforption of the different parts of the body, the organic particles of which enjoy a longer or fhorter life, according to the power which they originally received, and the ftrength and nature of the agents which operate on them. When thefe particles are, from the very firft, weak, a fmall ftimulus muft foon deftroy the little life which they poffefs, and their longevity will naturally be fhorter, even although no difproportionate action be excited in them. The fame law which prevails with regard to thefe particles, obtains alfo in the larger portions of the body; for a degree of inflammation, eafily fuftained by a ftrong part, will deftroy the fame part, if it has been previoufly weakened. The chief difference betwixt thefe proceffes is, that, in the one cafe,

the particles are abſorbed, and immediately replaced, whilſt, in the other, from the magnitude and degree of the deſtruction, and the extenſion of the loſs of all vital action, the part cannot be abſorbed, but remains, and putrifies *. Both proceſſes likewiſe reſemble each other, in this, that the death is dependent upon an action of the vital principle, which has this for its object. Death has been conſidered as merely a privation of life, or a ceſſation of action; but this negative

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* When a particle dies in a healthy part, or in an action of a part, then the abſorbents change it into a peculiar fluid, by an action of their vital power: But when a great number of particles die at once, in the immediate vicinity of each other, and the abſorbents have their action ſuſpended, and begin themſelves to die, then the part cannot be abſorbed or changed into a fluid, by the vital power of the animal, but it remains, and undergoes the putrefactive fermentation, as will afterwards be mentioned.

ſtate does not conſtitute abſolute death. Death is the deſcending of the vital principle of one ſpecies, to the condition of that of another of a lower degree, and, therefore, muſt imply activity, or a ſtate of change and converſion, referable to an action of the vital principle itſelf. There is, however, this intimate connection betwixt a ceſſation of action, or apparent death, and real or abſolute death, that when the vital principle is not employed in ſome other action, it has a natural tendency to aſſume the action of deſcent, or ſink down to a lower ſpecies. This deſcent would appear to take place more or leſs rapidly, according to the abſolute quantity of life which exiſts together, in the organ or part which is to die; for wherever the quantity is very ſmall before the action of deſcent commences, then it takes place very quickly. Hence, when a number of organic particles are

contained in any portion, and have their life ſtrong, and in due quantity, then they retain it for a conſiderable time, and deſcend only very ſlowly, at the ſame time that they are abſorbed and converted by the living power of the veſſels which take them up, into a ſubſtance different from their former condition. But if their life be in too ſmall quantity, or only a few inſulated particles be taken to act on, then the deſcent takes place quickly. Hence, if we kill an animal inſtantly, and cut out a muſcle, it will retain its animal life much longer, if the animal be healthy and ſtrong, than if it be weak and diſeaſed. Hence likewiſe, an animal will putrify ſooneſt, if it die from the action of any of the agentes diſſimiles, than from other cauſes; or, in other words, the interval betwixt apparent and real death is ſhorter. An amputated limb of a ſtrong man

will longer exhibit contraction, by the application of the zinc and ſilver, than the limb of a man who labours under plague, or cynanche maligna, were amputation to be performed in theſe diſeaſes; becauſe, in the one caſe, there is more real animal life remaining, at the time of ceſſation of evident action, or apparent death, than in the other; and, therefore, the action of deſcent takes place more ſlowly, and real death is longer of being produced. This deſcent may be accelerated, after apparent death, by ſuch cauſes as tend to deſtroy ſtill more the remaining vitality, by exciting an action in it, although this action be not attended by contraction, or other mechanical and very evident effects. Electric ſhocks, heat, putrid matter, toſſing about, &c. will haſten this, and induce the putrefactive fermentation, which does not take place in the ſolid fibre, un-

til the deſcent be produced; becauſe no ſuch extenſive chemical changes, and new arrangements or combinations, peculiar to common matter, can take place, as long as animal life remains. But, although the muſcular fibres of the muſcle will not putrify, until real death take place, yet the interſtitial fluid, which has leſs life, and, conſequently, dies ſooneſt, may begin to undergo this proceſs, before the fibres, or ſolid and organiſed part, be dead; but, almoſt immediately afterwards, the whole dies; becauſe putrid matter tends to deſtroy animal life; and, therefore, the interſtitial fluid in the muſcle haſtens the death of the fibre. Hence, cæteris paribus, the leſs interſtitial fluid that a part has, the longer will it live; becauſe then one agent, tending quickly to excite univerſal deſcent of vitality, is abſent.

We may, from theſe remarks, underſtand, firſt, why a part which dies in conſequence of inflammation, ſhould putrify much ſooner than the ſame part, if cut out of the body in health, and kept equally hot; becauſe the quantity of life, before apparent death takes place, is very ſmall: Second, why the mortification tends to ſpread, even independent of the continuance of its cauſe, or inflammation; for the putrid matter, which is already generated, tends to excite a fatal action in the ſurrounding parts, and is to be conſidered as an agens diſſimilis. If putrid matter be applied to a wound, that wound never heals without ſloughing.

The bad effects of mortification on the ſyſtem, are not to be attributed altogether immediately to the original inflammatory action, or to the fever, over-

powering, as it were, the conftitution; becaufe we often find thefe continue much longer, and equally violent, where no mortification takes place, without the fame injury being produced. It has been already mentioned, that all local actions have a tendency, fooner or later, to extend themfelves, and produce a general difeafe. The fuppurative and ulcerative action produces hectic, in a way which has been formerly explained. In the fame way, local mortification tends to induce a general and very dangerous difeafe, exciting that general ftate which we find induced by the application of putrid matter to delicate or divided parts, and inducing the tendency to the action of defcent, on account of the peculiar nature of the local action *. This

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* That the danger arifing from mortification is owing to the fympathetic extenfion of the local action, and not

general diſeaſe is alſo ſometimes induced, by the action of an agens diſſimilis, which operates on the ſyſtem, at the ſame time that the local action is produced, and may, in this caſe, be ſaid to be idiopathic. This is illuſtrated by cynanche maligna. The induction of this general ſtate, is one great cauſe of the rapidity with which gangrene ſometimes ſpreads; becauſe, if I may uſe the expreſſion, it prepares the parts for its reception. It diminiſhes the quantity of life and of natural action, and tends to induce the action of deſcent, in every particle. Very ſlight cauſes, then, will

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to the abſorption of putrid matter, and a general "depra-"vation of the fluids," is evident, from this circumſtance, amongſt many others, that the general action is greater when the local action affects delicate parts, with which the reſt of the ſyſtem ſympathiſes rapidly, than when it affects other parts, although in both caſes the abſorption may be ſuppoſed to be alike.

make a number of particles die at once. Hence, the local action can ſpread with eaſe.

The local action is marked by lividity of the parts, which gradually become black; the cuticle riſes up into bliſters, and an abominable ſmell is produced; the mortified part is quite cold and inſenſible; but the parts which are only aſſuming the gangrenous ſtate, and which may ſtill be ſaid to be inflamed, are extremely painful, becauſe the action is much greater than the power.

The general action is marked by great frequency and feebleneſs of the pulſe, unuſual weakneſs, which rapidly increaſes; by thirſt, ſqueamiſhneſs, foul tongue, and teeth covered with ſordes; heavy languid eye, and ſharp anxious features. Before death, the urine and ſtools fre-

quently come away involuntarily, and the patient lies in a kind of comatoſe ſlumber. At the ſame time, the action of deſcent commences, wherever the life is loweſt; and, owing to this, many of the animal excretions become fœtid. Sloughs alſo are formed, where the operation of foreign agents is greateſt, as, for inſtance, where the preſſure operates moſt, as on the ſhoulders, hips, &c.* Before death, the pulſe ſometimes becomes full; but then the artery has almoſt loſt its power, and become ſimilar to a vein, with reſpect to contraction. We feel it rather moving than beating, and it is impracticable to count any regular pulſation. When this happens,

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* Tulpius records an inſtance of univerſal gangrene, or mortification, which affected the whole body. Obſ. Med. Lib. III. c. 46. Many ſimilar inſtances are on record.

it is impoſſible that recovery ſhould take place *.

It has been ſuppoſed, that mortification was produced by ſome peculiar acrimony of the fluids †, or putrid ferment. Others maintain, that it is produced by the violence of the action of the veſſels, which throw out red blood in place of

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* In mortification, no one ever recovered from this ſtate ; becauſe the action of deſcent is then very nearly induced, and the tendency to it is ſo great now, that, independent of the correſpondent weakneſs, recovery is impoſſible. But, when this ſtate is induced by ſome other ſpecific diſeaſe, ſuch as fever, it is poſſible, though barely ſo, for recovery to take place ; for, in this caſe, the ſpecific diſeaſe is moſt probably gone, and ſimple weakneſs alone remains, as has been mentioned, when treating of the prelude to diſſolution.

† Valſalva tells us, that the ſerum, in a caſe of mortification, was ſo acrid, that when he taſted it, his tongue ſmarted for a whole day.

ſerum; and that, as this red blood cannot be converted into pus, it putrifies, and cauſes gangrene *. But theſe doctrines overlook the peculiar action of the living principle, and attribute to the changes of the fluids, that which really belongs to the operations of life. The generation of putrid matter, has been too often conſidered as a cauſe, and not a conſequence of diſeaſe. The humoural pathology has even been carried ſo far, that it has been maintained, that the blood itſelf might, by ſome cauſes, become putrid, and thus excite diſeaſes. But if blood be neceſſary for the continuance of life, what muſt we think of the theory, which talks of ſo complete a deſtruction and change of this fluid, as putrefaction muſt produce, and yet allows that the patient lives, and ſupports

* Bell on Ulcers, p. 100.

a diſeaſed ſtate! That the blood, like the reſt of the body, may be reduced to ſuch a ſtate, as to putrify very quickly, after being drawn, or after apparent death, is evident, and will be eaſily underſtood, from what has already been ſaid; but this is very different from a putrefaction of the blood, when circulating in the living body, and a conſequent diſeaſe.

Of the Modifications of the Inflammatory Action produced by the Nature of the Affected Part.

In the courſe of this diſſertation, it has been mentioned, that, in many inſtances, the ſymptoms of inflammation are modified by the ſtate of the part which it attacked. In ſome, the ſwelling is greater than in others: Some parts

are much more pained, and ſome feel much hotter than others.

In thé brain, inflammation produces ſimple pain, without heat, a feeling of tightneſs and confuſion, aggravated during the diaſtole of the artery. The eyes are red and ferocious, or unſettled, and very ſenſible with reſpect to light. Theſe ſymptoms proceed from the connection betwixt the eye and brain, by means of the ſhort optic nerve. The intellectual ſenſes are impaired, and the power of ſupporting ourſelves in an erect poſture is loſt. The brain is rendered redder by inflammation, and more turgid. The formation of organic particles is leſs affected than in many other parts; and, therefore, the intimate ſtructure of the inflamed part is leſs altered; but ſtill there is a change produced, the matter being tougher, and more like polypus.

The terminations are either refolution, or gangrene, (in which cafe the portion becomes fofter and thinner, and of a more dufky colour, or black, where there are membranes), or fuppuration*; in which cafe, a thick yellow pus is formed, and coma is produced. If this abfcefs be opened, the patient fometimes recovers, and the ulcerative action commences. The granulations are red, and very vafcular, which we learn, by finding them, after death, to be of a dark bloody colour. The pulfe is always quickened, and becomes hard; but its condition, with refpect to fullnefs and fmallnefs, is uncertain.

When the eye is inflamed, the veffels

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* If fuppuration does not take place, either the interftitial or the exhalent fluid is thrown out in greater quantity, and dropfy is produced.

become red and turgid; but the eye itself does not become larger. The sensation is partly that of a foreign body being in it, and partly of heat, or the same uneasy itchy sensation which heat produces, when it acts on the eye. The termination is generally an increased secretion of exhalent fluid.

The inflammation of the tonsil produces swelling, redness, and the sensation of simple pain, with very little heat. If, however, the action has been chiefly confined to the covering of the tonsil, or has been erysipelatous, then there is a sensation of heat and dryness. Any of the terminations may take place here; but that of gangrene is very rare in simple inflammation. When suppuration or ulceration take place, then the quantity of exhalent fluid, which is slightly changed, is increased, and the mouth is

ſilled with a tough ſlaver. When the internal part ſuppurates, or the ſurface ulcerates, thick yellow pus is formed. Sometimes the ſuperficial veſſels throw out a thick yellow ſubſtance, like coagulated lymph, (owing to a ſlight excoriation), producing ſpecks. The pulſe is quickened, but is not in general very hard. Sometimes it ſeems to be quickened, rather by the ſimple irritation, or pain, than by the ſympathetic fever, and, in this caſe, it is ſoft.

INFLAMMATION in the cheſt produces acute pain, aggravated at each inſpiration. The ſenſation of heat is very moderate. The terminations take place without any peculiarity *. The pulſe is hard and full, if the inflammation be moderate; but if it be exceſſive, or if

* Adheſion is the moſt frequent termination.

it occur in weak people, the pulſe is ſmaller.

Inflammation of the trachea, urethra, noſtril, &c. produces a ſenſation of ſmarting, with a ſlight degree of heat. The natural diſcharge is increaſed in quantity, and rendered thicker, and yellow. When this happens, the pain abates. If the inflammation be more violent, then this termination does not take place, but the parts become more turgid and painful; the exhalent fluid, or natural diſcharge, is either obſtructed, or is thrown out, like the interſtitial fluid, thick and changed, as in other parts, forming a lining to the canal. If the inflammation be ſtill more violent, then the organic particles alſo are affected, and become imperfect, or ulceration takes place.

When the ſtomach is inflamed, the

pain is generally acute, and often of the burning kind ; whilſt, from the increaſ-ed ſenſibility of the ſtomach, every thing is thrown up. The pulſe is ſmall and hard : The anxiety and oppreſſion are great. The termination which is moſt likely to take place, is gangrene.

Inflammation of the ſmall inteſtines produces nearly the ſame ſymptoms, only the vomiting is not ſo exceſſive. The heat is always conſiderable, and often ex-cruciating, as we obſerve in thoſe who take arſenic. When the great inteſtines are inflamed, the heat is commonly leſs ; and, if the inflammation be ſlight, it is even not at all perceived. The pain, however, is acute, and generally of the lancinating kind. The pulſe is frequent and hard, but not ſo contracted as when the ſmall inteſtines are affected. The termination moſt frequently is gangrene,

if reſolution be not obtained; but, in ſome caſes, ſuppuration and ulceration take place, which is ſeldom, if ever, the caſe, when the ſmall inteſtines are inflamed. The inteſtines may alſo have their internal ſurface chiefly affected; in which caſe, they are ſimilar to the urethra, &c. only the ſyſtem ſuffers more. This is productive of a dyſenteric affection, or increaſed diſcharge of thin ſlime, and, conſequently, is leſs dangerous than inflammation of the peritoneal covering, or of the whole ſubſtance, without this ſecretion. The ſame effects are produced in the bladder; for if its internal ſurface be chiefly affected, then the termination is moſt commonly an increaſed diſcharge of the ſlime; but if the whole ſubſtance be affected, then gangrene or ſuppuration is produced. The organic particles and interſtitial fluid are more affected than in the inteſtines; for

we find a thickening produced; and within the pores of the thickened fubftance, there is a gelatinous fluid, which is the changed interftitial fluid.

When bones are inflamed, the nature of the organic particles is changed, and they become much fofter: The interftitial fluid is alfo altered, and refembles thin fat foup. When this flows out, they are faid to fuppurate. The pain is great.

When cartilages or tendons are inflamed, the pain is likewife great. The part fwells, and becomes redder, and more opake, lofing the fhining appearance; and the interftitial fluid grows rather thicker. When fuppuration takes place, the pain does not abate fo much as in fome other parts; becaufe the action ftill is greater than the natural power of the part would produce. Inflam-

mation here may alſo produce ſloughs or gangrene.

Inflammation of membranes is alſo very painful: Their appearance, from the change of the nature of the organic particles, is always altered: They uniformly become thicker and more opake; and this ſtructure they often retain, after the inflammation goes off, as we ſee in the lucid cornea of the eye.

When muſcles are inflamed, they ſwell; the organic particles are in part affected; the interſtitial fluid becomes thicker, and the power of motion is greatly diminiſhed. The moſt frequent termination here is a ſecretion of the interſtitial fluid, ſimilar to that in health, but in rather greater quantity *. If,

* When a muſcle is inflamed at the time of death, we find the interſtices full of a lymphatic interſtitial fluid.

however, the inflammation has been more violent, which ſeldom happens in rheumatiſm, owing to the diffuſion of the action, then the ſuppurative action is produced, as we obſerve in wounds †, &c. The ſenſation is more of the wringing or pricking kind, than of heat or warmth, although there ſometimes be a kind of confuſed ſenſation, or reſemblance to warmth.

The peculiarities of glandular inflammation, with regard to ſuppuration, have been already mentioned. They have, in general, a conſiderable tendency to this termination; and, therefore, it is more difficult to have the inflammation reſolved; but the ſame cauſe makes it al-

† Wounds likewiſe act by ſuddenly producing a void, which, as has been already mentioned, excites the purulent action, even with a very moderate degree of previous inflammation.

moſt impoſſible for gangrene to take place. The pain is generally pricking, or lancinating, although in ſome particular glands, as, for inſtance, the teſticle, it is more of the gravitating kind.

When the cellular ſubſtance is inflamed, the ſwelling is conſiderable, and the ſenſation chiefly that of tenſion, or the ſame as if a perſon were rudely handling a very delicate part; but when the cutis becomes affected, the redneſs is great, and the feeling of heat very acute. All the terminations of inflammation may take place in the cellular ſubſtance; but the inflammation of the cutis generally ends either in a ſlight diſcharge of perſpirable matter, followed by a deſquamation of the cuticle, or in gangrene.

These modifications of ſimple inflam-

mation, dependent on the nature of the part affected, are likewise affected by specific modifications of the inflammatory action itself. Some of these induce ulceration in every part indiscriminately. Some never end in suppuration. Others tend chiefly to produce mortification. Some are attended with the sensation of heat more than others, &c.

END OF VOL. I.

GLASGOW:
PRINTED BY JAMES MUNDELL,
AYTON COURT.